INFORMATION TO USERS

This material was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in "sectioning" the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from "photographs" if essential to the understanding of the dissertation. Silver prints of "photographs" may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

5. PLEASE NOTE: Some pages may have indistinct print. Filmed as received.

Xerox University Microfilms
300 North Zeeb Road
Ann Arbor, Michigan 48106

75-29,170

ARNOLD, Jerry Louis, 1947-
ACCOUNTING FOR THE INVESTMENT TAX CREDIT AS A POTENTIAL CAUSAL FACTOR IN THE CORPORATE EQUIPMENT INVESTMENT DECISION: AN EMPIRICAL ANALYSIS.

The University of Michigan, Ph.D., 1975
Accounting

Xerox University Microfilms, Ann Arbor, Michigan 48106

THIS DISSERTATION HAS BEEN MICROFILMED EXACTLY AS RECEIVED.

ACCOUNTING FOR THE INVESTMENT TAX CREDIT AS A POTENTIAL CAUSAL FACTOR IN THE CORPORATE EQUIPMENT INVESTMENT DECISION: AN EMPIRICAL ANALYSIS

by
Jerry Louis Arnold

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
(Business Administration)
in The University of Michigan
1975

Doctoral Committee:

Assistant Professor Earl C. Keller, Co-Chairman
Associate Professor James E. Wheeler, Co-Chairman
Associate Professor Donald A. Jones
Professor Paul W. McCracken
Assistant Professor Timothy J. Nantell

DEDICATION

To Teri and Scott

ACKNOWLEDGMENTS

I am deeply indebted to Professors Earl C. Keller and James E. Wheeler, the co-chairmen of this project, for their untiring support and guidance. Their efforts contributed greatly to the successful completion of this project.

I also wish to express my sincere appreciation to the members of my dissertation committee: Professors Paul W. McCracken, Timothy J. Nantell, and Donald A. Jones for their efforts and valuable suggestions.

I wish to thank Professor Joseph A. Silvoso of the University of Missouri for the major role he played in my graduate education. His guidance and encouragement have been especially significant to me.

The timely completion of this project was possible due to the generous financial assistance provided by the Haskins and Sells Foundation, Ernst and Ernst Foundation, American Accounting Association, and William A. Paton Fund. I will always be grateful for the assistance provided.

I wish to thank Ms. Jean Whipple for her patience and skill in the typing of this project.

Finally, I wish to express special appreciation to my parents, Mr. and Mrs. Sylvan Arnold, and my wife, Teri, and son, Scott, for their continual encouragement

throughout my graduate education. To my wife and son a special note of appreciation for their tolerance during the preparation of this project.

CONTENTS

DEDICATION ii

ACKNOWLEDGMENTS iii

LIST OF TABLES vi

LIST OF FIGURES vii

CHAPTER

1. INTRODUCTION AND STATEMENT OF PURPOSE OF THE STUDY 1

   Introduction
   Purpose of This Study

2. RESEARCH DESIGN 14

3. SAMPLE SELECTION, DATA COLLECTION, AND MEASUREMENT 53

4. EMPIRICAL RESULTS 75

5. CONCLUSIONS 123

APPENDIX 132

BIBLIOGRAPHY 150

LIST OF TABLES

1-1	The Tax History of the Investment Tax Credit	3
3-1	Sample Industries	54
3-2	Deferred Firms	55
3-3	Sample Deferred Firms	57
3-4	Sample Flow-Through Firms	58
3-5A	Fitted Neoclassical Model Coefficients, Definitions of C_t Unrevised, Deferred Firms 1963-1973	70
3-5B	Fitted Neoclassical Model Coefficients, Definitions of C_t Unrevised, Flow-Through Firms 1963-1973	71
4-1A	Fitted Neoclassical Model Coefficients, Definition of C_t Revised, Flow-Through Firms, 1963-1973	77
4-1B	Fitted Neoclassical Model Coefficients, Definition of C_t Revised, Deferred Firms, 1963-1973	78
4-2	Fitted Neoclassical Model Coefficients Definition of C_t Revised, Flow-Through Firms 1964-1973	83
4-3A	Test for Homogeneity: Flow-Through Firms	86
4-3B	Detailed Sums of Squared Errors, Flow-Through Firms	88
4-4	Fitted Neoclassical Model Coefficients, Definition of C_t Revised, Deferred Firms, 1964-1973	97
4-5A	Test for Homogeneity: Deferred Firms . .	99
4-5B	Detailed Sums of Squared Errors, Deferred Firms	101
4-6A	Output Model Coefficients, Flow-Through Firms, 1963-1973	115

4-6B Output Model Coefficients, Deferred Firms, 1963-1973 116

4-7 Randomization Test: Matched Pairs 119

4-8 Randomization Test: Independent Samples 120

LIST OF FIGURES

4-1 Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

a. Babcock-Wilcox 89
b. Dow 90
c. International Harvester 91
d. Kraftco 92
e. Northrop 93
f. Safeway 94
g. TRW 95
h. Westinghouse 96

4-2 Plot of Individual Regression Residuals Versus Master Regression Residuals -- Deferred

a. Beatrice 102
b. Boeing 103
c. Combustion Engineering 104
d. DuPont 105
e. Ford 106
f. General Electric 107
g. General Motors 108
h. Great A&P Tea Co. 109

CHAPTER 1

INTRODUCTION AND STATEMENT OF PURPOSE OF THE STUDY

INTRODUCTION

The management of a company maintains detailed records for INTERNAL reporting purposes. Summarized, aggregated reports are abstracted from these records and periodically presented EXTERNALLY. Do these external reports impact upon the internal decision-making process? Some would maintain that they do.

In 1971, Charls Walker, an Assistant Treasury Secretary, addressed the debate surrounding the external accounting for a selective tax savings device: the investment tax credit (ITC). According to Mr. Walker:

> The Treasury Department's overriding interest in seeking the credit is to create jobs both in the short run and the long run by stimulating purchase of new machinery and equipment ... The vast majority of the companies have followed the former alternative ... reflecting the benefit of the credit immediately in earnings. It seems self-evident that ... businessmen will have less motivation to purchase new equipment if the benefits of the credit are not reflected in operating results when realized. [1]
>
> (emphasis added)

---

[1] Letter from Charls E. Walker to Senator Russell B. Long, November 12, 1971, excerpted in Journal of Accountancy, February 1972, p. 72.

This Treasury official was asserting that the external method of reporting an event, the availability of the ITC, would affect the occurrence of that event, acquisition of eligible assets. This assertion was based upon the assumption of an effect of financial reporting upon the internal decision making process. The existence of such an effect would seem to hinge upon the perception by internal managers that the prices of the firm's securities (equity and/or debt) would be affected by reported income.[2] In the opinion of this writer, the assumption that the method of external financial reporting affected the internal decision making process was testable; and the ITC issue offered a logical, meaningful device for such a test. A history of the events surrounding the ITC debate is presented in the succeeding paragraphs.

The ITC has been a selective fiscal tool of the United States Government since 1962. Except for a temporary suspension in 1966 and a temporary termination in 1969, the ITC has been in continual existence since inception. A brief history of the provisions of the ITC is depicted in Table 1-1.

---

[2]As stated in Footnote 8 (in this chapter), empirical evidence seems to contradict the assumption that security prices are affected by reported income.

TABLE 1-1 The Tax History of the Investment Tax Credit*

Investment Tax Credit		
Introduced	1-1-62	As part of the Revenue Act of 1962 (with a basis reduction feature)
	1-1-64	Basis reduction feature removed (virtually doubling the amount of the credit)
Suspended	10-10-66	Suspension was to last until 12-31-67
Reinstated	3-10-67	Investment credit again effective
Terminated	4-18-69	Terminated as part of the Tax Reform Act of 1969 (the removing of the investment tax credit)
Job Development Tax Credit		
Resurrected	4-1-71	If ordered after 3-31-71 and received 4-1-71 or later
		If ordered before 3-31-71 there is no credit unless it was received after 8-17-71 (effective for all assets received after 8-15-71 regardless of when ordered)

*subsequently called the Job Development Tax Credit

	Investment Tax Credit	Job Development Tax Credit
1. Useful lives for qualification	1/3 at 4 years 1/3 at 6 years 1/3 at 8 years	1/3 at 3 years 1/3 at 5 years 1/3 at 7 years
1a. Applicable percent maximum	7 percent	7 percent
2. Used property limitation	$50,000	$50,000
3. Application limitation on the credit	$25,000 plus 50 percent of tax liability over $25,000	$25,000 plus 50 percent of tax liability over $25,000
4. Carryovers and carrybacks	back 3 and forward 7	back 3 and forward 7

but pre 1971 investment tax credits are absorbed first, then current year credits, and finally carryback and carryforward credits from years subsequent to 1970

5. Recapture	Yes - but uses job development tax credit lives for disposition after 8-15-71	Yes
6. Credit percentage for Public Utility Property	3 percent	4 percent

Source: Compiled from class notes of Professor James E. Wheeler, the University of Michigan, Ann Arbor, Michigan

The accounting profession first encountered the ITC in 1962. The reporting policy wing of the American Institute of Certified Public Accountants, the Accounting Principles Board [APB], addressed the issue of reporting the ITC in APB Opinion No. 2:

> [concerning acceptance of the argument that the ITC effectively reduced the cost of an asset]
>
> In concluding that the cost reduction concept is based upon existing accounting principles we attach substantial weight to two points in particular. First, in our opinion, earnings arise from the use of facilities, not from their acquisition. Second, the ultimate realization of the credit is contingent to some degree on future developments ... [therefore] ... we conclude that the allowable investment credit should be reflected in net income over the productive life of acquired property and not in the year in which it is placed in service. 3

The accounting profession splintered over the validity of this position. In January 1963 the Securities and Exchange Commission [SEC] reacted to the reporting controversy by issuing Accounting Series Release No. 96, excerpted as follows:

---

[3]APB opinion No. 2, "Accounting for the Investment Credit" December 1962 in APB Accounting Principles: Original Pronouncements, American Institute of CPA's published by Commerce Clearing House, (Chicago: 6/30/73), p. 6508.

> (The reference to the 48%/52% breakdown therein stems from the basis reduction feature for tax purposes included in the original law and a 52% tax rate on corporate income.)
>
> In recognition of the substantial diversity of opinion which exists among responsible persons in the matter of accounting for the investment credit, the Commission will accept either a method which reflects the investment credit in income over the productive life of the acquired property or a method which reflects 48 percent of the investment credit (the maximum extent to which the credit can normally increase net income) in income as a reduction of the tax expenses of the year in which the credit arises and defers the balance of 52 percent to subsequent accounting periods during which depreciation allowances for tax purposes are reduced because the statutory requirement reduces the basis of the property for tax purposes by the amount of the investment credit. [4]

(It should be noted that the TAX and CASH FLOW implications of the ITC are unaffected by the method of financial reporting.)

The ABP reconsidered Opinion No. 2 and in March 1964 issued Opinion No. 4. The reasoning and justification supporting this opinion were expressed by the Board as follows:

> The Board's review of experience since the issuance of Opinion No. 2 shows that the investment credit has been treated by a significant

---

[4] Accounting Series Release No. 96, "Accounting for the Investment Credit," January 10, 1963, Accounting Series Releases, Compilation of Releases 1-112 Inclusive as in effect August 1968, United States Securities and Exchange Commission, pp. 247-249.

> number of companies as an increase in net income of the year in which the credit arose...
>
> The Revenue Act of 1964 eliminates the requirement imposed by the Revenue Act of 1962 that the investment credit be treated for income tax purposes as a reduction in the basis of the property to which the credit relates...
>
> It is the conclusion of this Board that the Revenue Act of 1964 does not change the essential nature of the investment credit and hence of itself affords no basis for revising our Opinion as to the method of accounting for the investment credit...
>
> However, the authority of Opinions of this Board rests upon their general acceptability. The Board, in light of events and developments occurring since the issuance of Opinion No. 2, has determined that its conclusions as there expressed have not attained the degree of acceptability which it believes is necessary to make the Opinion effective...
>
> In the circumstances the Board believes that, while the method of accounting for the investment credit recommended in ... Opinion No. 2 should be considered to be preferable, the alternative method of treating the credit as a reduction of Federal income taxes of the year in which the credit arises is also acceptable. [5]

In both 1967 and 1971 the APB attempted to return to its original, 1962, position through issuance of exposure drafts. Neither such attempt culminated in a formal

---

[5] APB Opinion No. 4 (Amending No. 2), "Accounting for the 'Investment Credit'" March 1964, in APB Accounting Principles: Original Pronouncements, American Institute of CPA's, published by Commerce Clearing House, (Chicago: 6/30/73), p. 6517.

opinion. In 1971 the Government interceded. According to a provision of the Revenue Act of 1971:

> It was the intent of Congress in enacting, in the Revenue Act of 1962, the investment credit allowed by Section 38 of the Internal Revenue Code of 1954, and it is the intent of the Congress in restoring that credit in this Act, to provide an incentive for modernization and growth of private industry. Accordingly, notwithstanding any other provision of law, on and after the date of the enactment of this Act
>
> (A) No taxpayer shall be required to use, for purposes of financial reports subject to the jurisdiction of any Federal agency or reports made to any Federal agency, any particular method of accounting for the credit allowed by such Section 38 ... [6]
>
> (emphasis added)

Congress, evidently, was accepting the assertion that the method used to externally report the ITC would be critical in a firm's internal decisions concerning acquisition of assets eligible for the credit. This Congressional assumption seemed to warrant empirical testing. Thus, the current study was initiated.

PURPOSE OF THIS STUDY

As stated above, the 1971 Revenue Act legislated

---

[6]Public Law 92-178, Section 50, Paragraph C printed in U.S. Code Congressional and Administrative News, 1, 92d Congress, 1st Session, 1971, p. 547.

acceptable financial reporting of the ITC. As will be shown shortly, this event in accounting history is clearly repeatable. As will be demonstrated by the research results, such action MAY NOT be economically justifiable.

Preceding the statement of purpose, in the form of the test hypothesis, is a disclaimer: IT SPECIFICALLY IS NOT THE PURPOSE OF THIS STUDY TO EXPLORE WHICH METHOD OF ACCOUNTING FOR THE ITC IS "PREFERABLE." This separate issue is interesting, and the literature is replete with arguments favoring both methods.[7]

It would appear, in reality, that a relevant prelude to serious debate concerning which method is preferable is an examination of the validity of the position that the decision to invest in equipment hinges upon which alternative(s) is allowed. If the selection of reporting method DOES affect the investment decision, the debate would be warranted. If the contrary situation is true, the raison d'etre for debate has seemingly been lessened.

Specifically, the hypothesis tested was that the accounting method adopted by a sample of major companies in various industries has not affected those companies'

---

[7]See, for instance, Richard T. Baker, "Accounting Is Being Challenged -- Needed a Timely Answer," The Ohio CPA, Winter 1968, pp. 7-12; and Robert H. Mills, "The Investment Credit," Financial Analysts-Journal, November/December 1971, pp. 71-77.

investments in plant and equipment.

The results did not provide definitive support for acceptance or rejection of this hypothesis. However, two important conclusions were suggested by the research. First, assertions of self-evident effect on management of alternative accounting principles were clearly NOT supported. Secondly, specific avenues for further research were opened.

The above conclusions are based upon an examination of the investment behavior of the sample firms. The methods of analysis of such behavior are considered in depth in the following chapter. The succeeding two chapters present the sampling design, data collection (and measurement) techniques, and empirical results. Finally, the concluding chapter attempts to synthesize the results and draw appropriate implications therefrom.

At this point, a second disclaimer would seem appropriate. The current research addresses the question of the effects (or lack thereof) of accounting for the ITC in the internal corporate equipment investment decision. Completely ignored is the relevance of debate regarding the ITC in light of security prices. Some

have posited that reported income affects stock prices.[8] Undeniably, the method of accounting for the ITC directly affects reported income. This separate issue, priority of ITC accounting method in the interface of reported income and stock prices, is interesting but not integrally related to the current study. Again, the issue addressed herein considers the internal investment decision as it is affected by the method of external reporting.

Although a very specific accounting problem (the ITC) is the subject of the current study, the potential implications seem boundless. The management group as a potential user of externally reported data has been largely ignored.[9] If, in fact, external reporting affects

---

[8]The empirical research seems to support the contrary contention that reported income does NOT affect stock prices. See for example, William H. Beaver and Roland E. Dukes, "Interperiod Tax Allocation, Earnings Expectations, and the Behavior of Security Prices," The Accounting Review (April 1972), Vol. XLVII, No. 2, pp. 320-332; "Interperiod Tax Allocation and δ Depreciation Methods: Some Empirical Results," The Accounting Review (July 1973), Vol. XLVII, pp. 549-559; Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers," Journal of Accounting Research (Autumn 1968), pp. 159-178; Robert G. May, "The Influence of Quarterly Earnings Announcements on Investor Decisions as Reflected in Common Stock Price Changes," Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. 9, Journal of Accounting Research, pp. 119-168; Robert S. Kaplan and Richard Roll, "Investor Evaluation of Accounting Information: Some Empirical Evidence," Journal of Business (April 1972), Vol. 45, No. 2, pp. 225-257.

[9]There are exceptions to this claim. An example is Eugene M. Lerner and Alfred Rappaport, "Limit DCF in Capital Budgeting," Information for Decision-Making: Quantitative and Behavioral Dimensions, edited by Alfred Rappaport, pp. 301-313, Prentice-Hall, 1970.

internal decisions, the gamut of financial decisions would seem ripe for examination. For example, research and development expenditures were, until recently, subject to a duality of acceptable external financial presentations. One must wonder whether the removal of this option will impact on future research and development expenditures.[10]

Further, accounting for leases has fostered heated debate for many years. A pervading question, closely related to the investment study herein undertaken, is "does it matter?"

As stated previously, the history of Government involvement in accounting rule-making may well repeat itself. In reaction to consideration by the Financial Accounting Standards Board (successor to the APB) of a proposal requiring lease capitalization, it has been noted that:

> Those who opposed capitalization of leases based their claims on economic grounds, rather than accounting theory, according to observers. There were frequent predictions of dire impact ...
>
> There seems to be little doubt that those opposed to capitalizing leases will seek to bring Congress into the controversy ...

---

[10]For a discussion of the imposition of a uniform method, see Statement of Financial Accounting Standards No. 2, "Accounting for Research and Development Costs," October 1974, Financial Accounting Standards Board, pp. 6-7.

> [Quoting from a letter sent by a legislator to accounting policy setters]:
>
> It seems OBVIOUS that if leases must be accounted for as indebtedness, additional amounts of equity capital will be required to balance financial ledgers. At the present high cost of capital, this could result in significant and inflationary effects on the prices of a great variety of goods and services ... I would hope that the decision would not be based on the theoretical niceties of accounting principles, but rather on the realities and on economic costs and benefits. [11]
> (emphasis added)

The legislator was maintaining (in a manner remarkably familiar) that accounting changes affecting leases OBVIOUSLY would place the corporate citizen in a difficult position. Against this background, of another untested assertion regarding the internal effects of a proposed external reporting policy, the current study is undertaken. The methodology to test the study hypothesis is discussed in the next chapter.

---

[11] Journal of Accountancy, January 1975, pp. 7-8.

CHAPTER 2

RESEARCH DESIGN

The hypothesis to be tested, again, is that the method of accounting for the ITC adopted by a sample of firms from various industries has not affected the plant and equipment investment behavior of these firms. Two types of firms were included in the sample: those which have consistently utilized the flow-through method and those using the deferred method. Necessarily, a comparison had to be drawn of the effects of accounting for the ITC between the two types of firms. In order to facilitate such a comparison, models of investment behavior were constructed for each of the firms included in the sample.

A review of the economic literature indicated the existence of sundry theories concerning microeconomic investment behavior. Jorgenson and Siebert[1] have performed empirical research comparing the validity of several proposed models derived from one such theory: the basic flexible accelerator theory. This theory depicts net investment as a function of changes in present and

---

[1]Dale W. Jorgenson and Calvin D. Siebert, "A Comparison of Alternative Theories of Corporate Investment Behavior," The American Economic Review 58 (September, 1968).

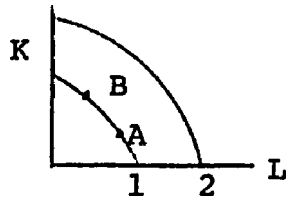
prior levels of desired capital (property). Explicit in the theory is the concept that a change in desired capital will precipitate the initiation of investment projects. These projects involve a lag of several periods from commencement to completion.[2] In equation form:[3]

N_t^N = projects INITIATED in period t.

u_o = portion of projects initiated in period t for which expenditures were made in period t.

---

[2]A firm, at any point in time, operates on a production frontier. This level of operations is dependent upon capital and labor inputs, as demonstrated below:



An infinite combination of K and L levels would generate the production level indicated by Curve 1 above. When the desired balance between K and L shifts, as from Point A to B on Curve 1, necessarily the level of desired capital has also been altered. Such shifts would be the consequence of changes in technology or relative costs of the labor/capital components. Further, suppose the firm presently operates on Curve 1 but desires operations at the level of Curve 2. In all likelihood, the level of desired capital will, again, be affected. Such a shift would result from expansion in demand for the firm's output.

[3]This discussion is based upon a more detailed explanation in Dale W. Jorgenson and James A. Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-1970," Econometrica, 35 (April 1967), pp. 177-178.

u_1 = portion of projects initiated in period t for which expenditures were made in period t+1.

u_n = portion of projects initiated in period t for which expenditures were made in period t+n.

$\sum_{i=0}^{n} u_i = 1$ if all projects are eventually completed within n+1 periods.

In any single period net investment (gross investment - replacement investment) is a function of current changes in desired capital and changes in prior levels of desired capital which have not been fully satisfied:

N_t = net investment expenditures in period t.

$$N_t = u_0[K_t^* - K_{t-1}^*] + u_1[K_{t-1}^* - K_{t-2}^*] + \ldots + u_n[K_{t-n}^* - K_{t-n-1}^*] \quad (1)$$

where:

K_t^* = level of desired capital

u_i = portion of the related changes for which expenditures were made in period t.

Expression (1) is referred to as a distributed lag function, with net investment as the dependent variable. The

u_i's represent the coefficients of the independent variables, the changes in desired capital. These u_i terms correspond to those discussed in the preceding section. An example may aid in the visualization of this relationship.

Assume a firm experienced the following changes in desired capital:

Period t-3	$100
t-2	200
t-1	300
t	400
t+1	150
t+2	250
t+3	350

The equations for net investment for periods t through t+3 might appear as follows:

$$t: \quad N_t = u_0(400) + u_1(300) + u_2(200) + u_3(100)$$

$$t+1: \quad N_{t+1} = u_0(150) + u_1(400) + u_2(300) + u_3(200)$$

$$t+2: \quad N_{t+2} = u_0(250) + u_1(150) + u_2(400) + u_3(300)$$

$$t+3: \quad N_{t+3} = u_0(350) + u_1(250) + u_2(150) + u_3(400)$$

Viewed horizontally, the above expressions describe investment expenditures during one period. Viewed

diagonally, they portray the completion pattern for projects begun during one period. For example, the change in desired capital during period t ($400) is translated into investment expenditures during periods t through t+3 by applying the corresponding u_i term. By the end of period t+3, this change in desired capital has been accomplished.

The specification of desired capital (K^*) is the differentiating factor among the various flexible accelerator models. To reiterate, the purpose of this model development is to yield the device through which the effects, if any, of accounting for the ITC can be compared between the two types of firms.

Desired capital is immeasurable with currently known methods of analysis. As a result, surrogate, or proxy measures, must be specified to incorporate the effects of desired capital changes in an investment model. The following example portrays the use of such proxy variables in general.[4] Assume a "true" relationship is defined as follows:

$$Y_t = B_1 X_t + \varepsilon_t \qquad (2)$$

---

[4]This example is based upon the discussion of proxy variables in Potluri Rao and Roger Le Roy Miller Applied Econometrics (Belmont, California: Wadsworth Publishing Co., 1971), pp. 82-88.

Data are unavailable on X_t. Another variable, Z_t, is used as a proxy, generating the following relationship:

$$X_t = b\ Z_t + w_t \tag{3}$$

The resultant estimation equation for Y_t with Z_t as the independent variable would appear as follows:

$$Y_t = \hat{B}_1\ Z_t + \hat{\varepsilon}_t \tag{4}$$

$E(\hat{B}_1) = B_1 \cdot b_{xz}$, where b_{xz} is computationally equivalent to b in Expression (3) above. $\hat{B}_1$ is not an unbiased estimator of B_1 unless $b_{xz} = Cov(X,Z)/Var(Z) = 1$.

The importance of selecting a meaningful proxy measure is underscored by Rao and Miller:

> ... the bias in the estimates of the parameters will decrease with the goodness of the proxy variable in approximating the left-out variable. [5]

In the empirical tests of the basic flexible accelerator theory, various proxy variables for desired capital have been suggested, including:[6]

---

[5] Ibid., p. 85.

[6] For a discussion of these definitions see Jorgenson and Siebert, "A Comparison of Alternative Theories of Corporate Investment Behavior," pp. 694-97.

(A) OUTPUT

$$K_t^* = \alpha Q_t, \tag{5}$$

where:

Q_t = total quantity of production during period t measured in constant dollars to allow aggregation of heterogeneous products. The price level deflation could be accomplished through utilization of the wholesale price index [WPI] applicable to the firm's industry group.

α = ratio of desired capital to output. α represents the regression coefficient relating quantity of output to level of desired capital.

(B) INTERNAL FUNDS AVAILABLE (LIQUIDITY MODEL)

$$K_t^* = \alpha L_t \tag{6}$$

where:

L_t = cash flow in current dollars generated by operations during period t, deflated for price level changes. An appropriate deflator could be the investment goods price index for machinery and equipment.

α = ratio of desired capital to flow of internal funds available for investment. α represents the regression coefficient relating flow of internal funds available to level of desired capital.

(C) MARKET VALUE OF THE FIRM (EXPECTED PROFITS MODEL)

$$K_t^* = \alpha V_t \tag{7}$$

where:

V_t = market value of the firm, defined as outstanding stock and debt at the beginning of period t, deflated by the gross national product implicit price deflator.

α = ratio of desired capital to market value of the firm. α represents the regression coefficient relating market value of the firm to level of desired capital.

(D) OUTPUT, DEFLATED BY PRICE OF CAPITAL SERVICES (NEOCLASSICAL MODEL)

$$K_t^* = \alpha \frac{P_t Q_t}{C_t} \tag{8}$$

where:

P_t = end of period t price level, as measured by

the wholesale price index applicable to the firm's industry gorup.

Q_t = output as previously defined.

C_t = price (implicit rental value) of capital services. C_t serves as the discount or capitalization rate applied to current output. The derivation of C_t will be discussed in a subsequent section.

α = ratio of desired capital to output, adjusted for the price of capital services. α represents the regression coefficient relating output, adjusted for the price of capital services, to level of desired capital.

According to Jorgenson and Siebert:

> Our final conclusion is that ... the neoclassical theory of investment behavior we have examined is clearly superior to capacity utilization (output) or profit expectations theories of investment. The neoclassical theory is far superior to internal funds theories of investment. 7

---

[7] Ibid., pp. 705-706.

The above conclusion was reached based upon a comparison of the models as to the following criteria: minimum regression standard error; accuracy in prediction of "peaks" and "valleys" of investment expenditures; and number of desired capital terms which entered the regression model.

Based upon the above conclusion, and other studies reviewed by the writer including Eisner[8] and Meyer and Kuh,[9] the decision was reached to approach the current question through utilization of the neoclassical model. The details of this model are explored in the ensuing paragraphs.

The neoclassical model for individual firm investment can be developed as follows, in light of the preceding discussion:

We have from Equation (1),

$$N_t = u_0 [K_t^* - K_{t-1}^*] + u_1 [K_{t-1}^* - K_{t-2}^*] + \ldots \quad (1)$$

and from Equation 8,

$$K_t^* = \alpha \frac{P_t Q_t}{C_t} \quad (8)$$

---

[8] R. Eisner, "A Permanent Income Theory for Investment," American Economic Review, 57 (June 1967), pp. 363-90.

[9] J. Meyer and E. Kuh, The Investment Decision (Cambridge: Harvard University, 1957).

By substituting, it follows that,

$$N_t = u_0 [\alpha \frac{P_t Q_t}{C_t} - \alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}}]$$

$$+ u_1 [\alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}} - \alpha \frac{P_{t-2} Q_{t-2}}{C_{t-2}}] + \ldots \quad (9)$$

Since α, the regression coefficient, is a constant for all terms, we can rewrite Equation 9 as,

$$N_t = \alpha u_0 [\frac{P_t Q_t}{C_t} - \frac{P_{t-1} Q_{t-1}}{C_{t-1}}]$$

$$+ \alpha u_1 [\frac{P_{t-1} Q_{t-1}}{C_{t-1}} - \frac{P_{t-2} Q_{t-2}}{C_{t-2}}] + \ldots \quad (10)$$

Net investment, the dependent variable, is equal to the difference between gross investment and replacement investment. The disaggregation of gross investment into net and replacement components is not reported in currently published sources for domestic corporations. As a result, the components must be estimated. Such estimation is conditioned upon a theory of replacement investment.

One such theory expresses replacement investment as a constant proportion of beginning net capital stock. Jorgenson explains the selection of the constant proportionality theory as follows:

> ... we assume that the flow of replacement generated by a given flow of investment goods is distributed over time in accord with an exponential distribution. This assumption implies that the flow of investment at any point of time is proportional to the accumulated stock of investment goods ... While empirical studies of 'survival curves' for individual pieces of equipment reveal a wide variety of possible distributions, there is a deeper justification for the use of the exponential distribution. This justification arises from a fundamental result of renewal theory, namely, that replacement approaches an amount proportional to the accumulated stock of capital whatever the distribution of replacements for an individual piece of equipment, provided that the size of the capital stock is constant or that the stock is growing at a constant rate (in the probabilistic sense).10
>
> (emphasis added)

Empirical support for the above theory of replacement investment has been provided by Meyer and Kuh,[11] and Jorgenson and Stephenson.[12]

The constant proportionality of replacement investment and net capital stock allows the expression for net investment to be characterized as follows:

---

[10]Dale W. Jorgenson, "The Theory of Investment Behavior," Determinants of Investment Behavior, edited by Robert Ferber, from A Conference of the Universities - National Bureau Committee for Economic Research of the National Bureau of Economic Research, Columbia University Press, New York: 1967.

[11]Meyer and Kuh, pp. 191-194.

[12]Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-60," pp. 211-212.

$$N_t = I_t - \delta K_t \qquad (11)$$

where:

I_t = gross investment in period t.

K_t = net capital stock at the beginning of period t.

δ = constant of proportionality between replacement investment and net capital stock.

By substituting Equation 11 into Equation 10, the distributed lag function for net investment becomes:

$$[I_t - \delta K_t] = \alpha u_0 \left[\frac{P_t Q_t}{C_t} - \frac{P_{t-1} Q_{t-1}}{C_{t-1}} \right] + \alpha u_1 \left[\frac{P_{t-1} Q_{t-1}}{C_{t-1}} - \frac{P_{t-2} Q_{t-2}}{C_{t-2}} \right] + \ldots \qquad (12)$$

The above expression can be notationally simplified through utilization of a lag operator. For any sequence X(t), L, the lag operator exists such that $L^n X(t) = X(t-n)$. Therefore, Equation (12) can be rewritten:

$$[I_t - \delta K_t] = [u_0 + u_1 L + u_2 L^2 + \ldots] \left[\alpha \frac{P_t Q_t}{C_t} - \alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}} \right] \qquad (13)$$

U(L) abbreviates the expression for the lag coefficients $[u_0 + u_1 L + u_2 L^2 + \ldots]$.

Substituting, Equation (13) becomes:

$$[I_t - \delta K_t] = U(L)\left[\alpha \frac{P_t Q_t}{C_t} - \alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}}\right] \qquad (14)$$

As is clear from Expression (14), a current change in desired capital impacts upon the investment expenditures for expansion in the current and several future periods. Such a process, characterized by a multi-period effect of a single independent variable observation, is referred to as a moving-average scheme. The order of the scheme is determined by the number of periods affected by the single observation. In the present case new observations, each manifesting such a rippling effect are introduced each period in which desired capital changes. This compounding of the moving-average scheme creates a complex model formulation. Fortunately, the efficiency of implementation of the model can be improved through utilization of a property of U(L).

A function, such as U(L), is equivalent to the ratio of two polynominals, $\frac{Y(L)}{W(L)}$, if this ratio is the rational generating function for U(L). In order to be the rational generating function, the numerator and denominator polynomials must be in the same variable and the denominator polynomial cannot be the zero polynomial. As will be shown below, the re-specification of U(L) as the ratio of two polynomials, $\frac{Y(L)}{W(L)}$, would significantly simplify the

utilization of the neoclassical model. In order to allow for such substitution, numerator and denominator polynomials in the lag operator, L, were defined and the denominator polynomial was not the zero polynomial. The significance of this latter condition to the neoclassical model will be demonstrated shortly. Further, it is implicitly assumed that the polynomials Y(L) and W(L) have no characteristic roots in common which assures that the rational generating function can be specified in only one way as the ratio of two polynomials.[13]

Substitution of $\frac{Y(L)}{W(L)}$ into Equation (14) generates the following expression:

$$[I_t - \delta K_t] = \frac{Y(L)}{W(L)} \left[\alpha \frac{P_t Q_t}{C_t} - \alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}} \right] \qquad (15)$$

Multiplication through by W(L) results in the formulation of Expression (16) below:

$$W(L)[I_t - \delta K_t] = Y(L)\left[\alpha \frac{P_t Q_t}{C_t} - \alpha \frac{P_{t-1} Q_{t-1}}{C_{t-1}} \right] \qquad (16)$$

This expression reduces the complexity of the equivalent Expression (14), as will be demonstrated in the succeeding discussion.

---

[13]For an excellent discussion of the utilization of rational generating functions in distributed lag analysis, refer to Dale W. Jorgenson, "Rational Distributed Lag Functions," Econometrica, 34 (January 1966), pp. 135-49.

The polynomial, Y(L), in Expression (16) is a moving-average scheme of a lower order (fewer terms) than the polynomial U(L) in Expression (14). This reduction in order was accomplished through introduction of the autoregressive process defined by W(L) in Expression (16). An autoregressive scheme expresses a variable as a function of prior levels of that variable. Current $(I_t - \delta K_t)$ is related to prior levels through operation of the lag operator W(L). The benefit from introduction of W(L) derives from the relationship of the moving-average and autoregressive schemes. In an autoregressive scheme, the effects of observations which occurred prior to the current period have been captured in prior values of the dependent variable. Therefore, inclusion of such prior values as separate explanatory variables is equivalent to specification of the actual impacts. Further, inclusion of such values is requisite in the re-specification of U(L) as $\frac{Y(L)}{W(L)}$. If the relationship was not autoregressive, the denominator polynomial would equal zero and the underlying conditions for rationality of the function would be violated. In a purely autoregressive formulation, the explanatory variables would consist entirely of prior levels of the dependent variable. In the current application, the simultaneous existence of several moving-average schemes within the model precludes definition in a purely autoregressive manner. The impacts which have not

been captured by the autoregressive scheme are defined by Y(L), a moving-average process.

The net result of the above re-characterization of Expression (14) is a reduction in required explanatory terms and improved efficiency of implementation of the model. Expression (16) is referred to as a mixed auto-regressive, moving-average time series process. It can be simplified as follows:

W_0 is assumed equal to 1 without loss of generality.[14] Therefore:

$$[I_t - \delta K_t] + W_1[I_{t-1} - \delta K_{t-1}] + \ldots$$

$$= Y_0\left[\alpha\frac{P_tQ_t}{C_t} - \alpha\frac{P_{t-1}Q_{t-1}}{C_{t-1}}\right] + Y_1\left[\alpha\frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \alpha\frac{P_{t-2}Q_{t-2}}{C_{t-2}}\right]$$

$$+ \ldots \qquad (17)$$

Rearranging terms and establishing I_t as the dependent variable, Expression (17) is equivalently written:

---

[14] Ibid., p. 137.

$$I_t = Y_0[\alpha \frac{P_tQ_t}{C_t} - \alpha\frac{P_{t-1}Q_{t-1}}{C_{t-1}}]$$

$$+ Y_1[\alpha \frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \alpha\frac{P_{t-2}Q_{t-2}}{C_{t-2}}] + \ldots$$

$$- W_1[I_{t-1} - \delta K_{t-1}] - W_2[I_{t-2} - \delta K_{t-2}]$$

$$- \ldots + \delta K_t \qquad (18)$$

If the selected distributed lag function for a sample firm included current and two lagged changes in desired capital and one lagged net investment term, the equation would appear as follows:

$$I_t = \alpha Y_0[\frac{P_tQ_t}{C_t} - \frac{P_{t-1}Q_{t-1}}{C_{t-1}}]$$

$$+ \alpha Y_1[\frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \frac{P_{t-2}Q_{t-2}}{C_{t-2}}]$$

$$+ \alpha Y_2[\frac{P_{t-2}Q_{t-2}}{C_{t-2}} - \frac{P_{t-3}Q_{t-3}}{C_{t-3}}]$$

$$- W_1[I_{t-1} - \delta K_{t-1}] + \delta K_t \qquad (19)$$

To complete Equation (19), an error term, ε_t, would be generated which is assumed to possess the following statistical properties:

$E(\varepsilon(t)) = 0$

$V(\varepsilon(t)) = \sigma^2 = \text{constant}$

$C[\varepsilon(t), \varepsilon(t-\tau)] = 0 \text{ for all } \tau \neq 0.$

This error term would accompany the estimates of the neoclassical model parameters generated through the application of ordinary least squares procedures.

The preceding discussion has defined each element of Equation (19) with the exception of C_t, the price of capital services. This factor is the key differentiating element between the neoclassical and pure output definitions of desired capital given at Equations (5) and (8), respectively. C_t attempts to capture the cost of utilization of facilities. As the cost of providing capital services increases, ceteris paribus, the desired level of capital stock would decrease under the neoclassical formulation. Contrarily, the output definition assumes that the level of desired capital would be unaffected by its corresponding cost. As stated previously, empirical evidence supports the contention that inclusion of the cost of capital services element in the capacity utilization (output) model for investment expenditures improves the explanatory ability of that model. In the succeeding paragraphs, the elements of C_t are considered in depth:

$$C_t = \frac{q_t}{(1-u_t)}\left[(1-u_t w_t)\delta + r_t - \frac{\dot{q}_t}{q_t}\right]^{16} \qquad (20)$$

where

q_t = investment goods price index

---

[16]This definition was utilized by Jorgenson and Siebert in their studies. See "A Comparison of Alternative Theories of Corporate Investment Behavior," pp. 695-96 and "Optimal Capital Accumulation and Corporate Investment Behavior," Journal of Political Economy, 76 (Nov.-Dec. 1968), pp. 1127 and statistical appendix available from the authors.

δ = rate of replacement. This rate may be represented as $\frac{R_t}{K_1}$ where:

R_t = replacement cost in constant dollars of assets actually replaced.

K_1 = net capital stock [property] at the beginning of period t, in constant dollars.

$$u_t = \text{tax rate} = \frac{\text{recorded profits before taxes} - \text{recorded profits after taxes}}{\text{recorded profits before taxes}}$$

w_t = tax deductible portion of economic depreciation. CCA, recorded depreciation, is utilized as a surrogate for tax depreciation and $q_t R_t$, current cost of actual replacements, is used as the measure for economic depreciation.

$$r_t = \text{cost of capital} = \frac{PAT+CCA-q_t R_t+\dot{q}_1 K_1+\dot{q}_2 K_2+\dot{q}_3 K_3}{VTA}$$

PAT = profits after taxes

VTA = value of total assets, defined as the market value of the firm's securities outstanding at the beginning of the period.

K_1 = depreciable assets

K_2 = depletable assets

K_3 = nondepreciable assets on which holding gains occur, e.g., inventory.

$\dot{q}_t = (q_t - q_{t-1})$

In words,

> ... cost of capital is measured by the ratio of recorded profits after taxes, adjusted for any differences between recorded depreciation and replacement cost, and capital gains on assets, to the value of total assets. 17

By sutstituting the definitions for $W(\frac{CCA}{q_t R_t})$ and $\delta(\frac{R_t}{K_1})$, the above expression can be simplified, resulting in the following characterization of C_t:

$$C_t = \frac{q_t r_t}{(1-u_t)} + \frac{q_t R_t}{(1-u_t)K_1} - \frac{u_t CCA}{(1-u_t)K_1} - \frac{\dot{q}_t}{(1-u_t)} \quad (21)$$

The above four elements of C_t can be interpreted as follows:

TERM 1: $\frac{q_t r_t}{(1-u_t)}$ represents the earnings rate (cost of capital), adjusted as follows: q_t, the investment goods price index, adjusts r_t for changes in the relative price level from period to period. As the firm faces an increasing (or decreasing) price structure for investment goods, the cost of capital would correspondingly increase (or decrease). Further, the denominator, $1-u_t$,

---

[17] This definition is included in the statistical appendix to Jorgenson and Siebert, "Optimal Capital Accumulation."

adjusts the cost of capital for the effects of taxation. The earnings rate is the basic element of the cost of capital services. Nevertheless, certain relevant factors ignored therein, are separately defined.

TERM 2: $\frac{q_t R_t}{(1-u_t)K_1}$ represents the replacement rate, adjusted for the effects of taxation. As demonstrated above, r_t, is computed <u>after</u> subtracting "economic" depreciation. However, in determining the cost of furnishing capital services, the firm must specifically consider the expiration of utility of its capital assets. Therefore, this term is added to the cost of capital, in an attempt to capture the economic cost of fixed asset expiration.

TERM 3: $\frac{u_t CCA}{(1-u_t)K_1}$ represents the tax savings rate, adjusted for the effects of taxation. The inclusion of this term tends to mitigate the effect of the addition of term 2 above. That term specifically included the "economic" depreciation of a firm's assets. This term recognizes the tax savings which result from deductibility of "book" depreciation charges. It, therefore, has the effect of offsetting some

of the influence of the inclusion of term 2.

TERM 4: $\frac{\dot{q}_t}{(1-u_t)}$ represents the holding gains rate, adjusted for the effects of taxation. This term reduces the cost of capital services for the occurrence of unrecorded holding gains on fixed property. The subtraction of these gains recognizes the economic benefit derived by a firm from utilization of its existent fixed assets during a period of rising prices.

The above discussion is based upon the theoretical justification for the definition of C_t. As relevant, however, is the empirical support provided by several econometric studies.[18] Inclusion of C_t in the manner defined above resulted from both theoretical and empirical considerations.

Continuing in the development of C_t, the next step is to determine where in the existent model the ITC will impact. Since the tax savings rate is a component of C_t, the price of capital services, it seems reasonable that the ITC will enter therein. Indeed, Hall and

---

[18] Jorgenson and Siebert, "A Comparison of Alternative Theories of Corporate Investment Behavior," and "Optimal Capital Accumulation and Corporate Investment Behavior"; Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-1960."

Jorgenson reached a similar conclusion in an empirical study which they conducted.[18]

The inclusion of the ITC produces the following definition of C_t:

$$C_t = \frac{q_t r_t}{(1-u_t)} + \frac{q_t R_t}{(1-u_t)K_1} - \frac{u_t CCA+ITC}{(1-u_t)K_1} - \frac{\dot{q}_t}{(1-u_t)}. \qquad (22)$$

(The measurement section of the following chapter addresses each component of C_t in detail.)

The inclusion of ITC as an element of C_t precludes its separate definition as a dummy variable in the neoclassical model. Such dual placement would generate a condition of collinearity, which would negate the significance of coefficient isolation and comparison.

---

[18] Robert E. Hall and Dale W. Jorgenson, "Tax Policy and Investment Behavior," The American Economic Review, Vol. LVII, June 1967, p. 393. In a macroeconomic application, the authors offered the following definition of C:

$$C = q(r+\delta)\frac{(1-k)(1-uz)}{(1-u)}$$ where:

C = implicit rental value of capital services.

q = price of capital goods.

r = discount rate.

δ = rate of replacement.

k = rate of investment tax credit.

u = tax rate.

z = present value of depreciation deduction on one dollar's investment (after ITC).

The neoclassical model developed above will serve as the basis of initial comparisons between flow-through and deferred firms. Annual data were gathered for the years 1963 through 1973, inclusive. Although the ITC became effective on January 1, 1962, APB Opinion No. 2 was not issued until December of 1962.[19] Therefore, 1963 was the first year during which a stated accounting policy was in effect.

In fitting the models for each sample firm, regressions were run under alternate specifications of the distributed lag functions. The specification with the minimum regression standard error was isolated.[20] An infinite number of distributed lag functions were available for each firm. As a result, certain restrictions were placed on the possible specifications examined. For the current study, current and up to three lagged changes in desired capital and up to two lagged net investment terms were specified, considering successive powers of the lag operator, beginning with the zero power

---

[19] Accounting Principles Board Opinion No. 2, "Accounting for the Investment Tax Credit," December 1962, in APB Accounting Principles Original Pronouncements, 2/1/71, p. 6508, published for the American Institute of Certified Public Accountants by Commerce Clearing House.

[20] For a discussion of this criterion, see Jorgenson and Siebert, "Comparison of Alternate Theories," p. 699 and Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-1960," pp. 181-82.

for changes in desired capital terms and the first power for net investment terms. Support for such an approach can be found in Jorgenson and Siebert and Jorgenson and Stephenson.[21]

The analytical techniques are presented in the succeeding paragraphs.

The final form of the neoclassical model, again, including an error term and a constant, appears as follows, for each firm:

$$I_t = a + \alpha Y_0 \left[\frac{P_t Q_t}{C_t} - \frac{P_{t-1} Q_{t-1}}{C_{t-1}} \right] + \alpha Y_1 \left[\frac{P_{t-1} Q_{t-1}}{C_{t-1}} - \frac{P_{t-2} Q_{t-2}}{C_{t-2}} \right] + \ldots - W_1 [I_{t-1} - \delta K_{t-1}] - \ldots + \delta K_t + \varepsilon_t \qquad (23)$$

The essence of the hypothesis to be tested is that the investment behavior of the sample flow-through and deferred firms did NOT differ significantly intra-group or inter-group. Such investment behavior was characterized by the coefficients of the firms' distributed lag functions. Therefore, the test for similar investment behavior was viewed as a test of homogeneity of the coefficients of the individual distributed lag functions intra-group and inter-group.

[21] Jorgenson and Siebert, "A Comparison of Alternative Theories of Corporate Investment Behavior," p. 69; Jorgenson and Stephenson, "Time Structure of Investment Behavior in U.S. Manufacturing 1947-1960," Review of Economics and Statistics, 49 (February 1967), pp. 21-22 and "Investment Behavior in U.S. Manufacturing, 1947-60," p. 182.

Jorgenson and Stephenson [22] suggest a test for coefficient homogeneity. The implementation of this test included the following procedures.

For each sub-group (deferred/flow-through) the sums of squared errors from the selected distributed lag function for each firm were aggregated. In order to test for homogeneity WITHIN each sub-group, these aggregate summed errors were compared to those resulting from application of master models to the data of the firms in each sub-group. It should be emphasized that a different master model was generated for each sub-group. The coefficients of these master models were determined as follows: The data from the firms comprising a sub-group were treated as a set of sample observations from the same population. Next, the distributed lag function containing all possible parameters (within the constraints discussed previously) was fitted to this data, resulting in the generation of the master model for that sub-group.

The F-statistic, defined as below, was utilized to compare the residuals generated by the individual and master models. For purposes of this test, the assumption of the same standard errors across firms in a sub-group was adopted.

---

[22] Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-1960," pp. 212-15.

The test statistic appears as follows:[23]

$$F[\delta_1, \delta_2] = \frac{\frac{\Sigma SS_{m_i} - \Sigma SSI_i}{mn-K_a - \Sigma(n-K_i)}}{\frac{\Sigma SSI_i}{\Sigma(n-K_i)}}$$

where:

δ_1 = degrees of freedom relevant to the numerator

$$= [\, mn-K_a - \sum_{i=1}^{m} (n-K_i)\,]$$

δ_2 = degrees of freedom relevant to the denominator = $\sum_{i=1}^{m}(n-K_i)$

m = number of firms in the sub-group

n = number of observations per firm

K_a = number of parameters in the master regression model

K_i = number of parameters in the model for the ith firm

SS_{m_i} = sum of squared errors from application of the master regression model to the ith firm

---

[23]This statistic is based upon the one utilized by Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-60," p. 214.

SSI_i = sum of squared errors from the individual regression model of the ith firm

The justification for the above definition of the F-statistic derives from the additive property of chi-square distributions, in instances where the distributions are independent. Such independence is assumed herein.

If $F_{(ACTUAL)} < F_{(CRITICAL)}$, the hypothesis of intra-group homogeneity could not be rejected. Contrarily, if $F_{(ACTUAL)} > F_{(CRITICAL)}$, rejection would be indicated. The above tests can also be applied with individually fitted capital stock coefficients and/or intercepts in the otherwise master models. The relevance of this procedure to the current study is addressed in Chapter 4.

As will be discussed below, the inter-group homogeneity test would assume significance only if intra-group homogeneity were evident in each sub-group. The implementation of the inter-group test would follow the above procedures, with the master model fitted to the data from all sample firms.

The array of possible results for the various homogeneity tests appears as follows:

	FLOW-THROUGH	DEFERRED	ALL
(1)	Homogeneous	Homogeneous	Homogeneous
(2)	Heterogeneous	Heterogeneous	
(3)	Heterogeneous	Homogeneous	
(4)	Homogeneous	Heterogeneous	
(5)	Homogeneous	Homogeneous	Heterogeneous
(6)	Heterogeneous	Homogeneous	
(7)	Homogeneous	Heterogeneous	
(8)	Heterogeneous	Heterogeneous	

Result (1) would lend support to the acceptance of the hypothesis that accounting for the ITC did NOT affect the plant and equipment investment decision. No significant differences between the investment behavior of the two types of firms would be evident.

Result (5) would lend support to the rejection of the test hypothesis. The individual sub-groups manifest insignificant, if any, intra-group differences. However, when aggregated, the results are not homogeneous. The groups evidently would be characterized by differing investment behaviors. IT SHOULD BE RE-EMPHASIZED THAT THE BASIS FOR SEPARATE GROUP CLASSIFICATION IS THE METHOD OF ACCOUNTING FOR THE ITC.

The above array indicates that only in the event of intra-group homogeneity, as indicated by results (1) and (5), would a test for inter-group homogeneity be

conducted. The significance of this test rests on the condition that the firms in each sub-group could be characterized by a uniform investment behavior. The occurrence of results (2), (3), (4), (6), (7), or (8) would prompt performance of alternate tests, as discussed in the succeeding paragraphs.

As previously mentioned, at Equation (22), the neoclassical model precludes separate specification of a dummy variable for the ITC. However, such preclusion does <u>not</u> result when alternative measures of desired capital are used. Since the relevant data will already be gathered for the neoclassical approach, the output model has been selected for this examination.

As described at Equation (5) in the output model desired capital is proportional to output:

$$K_t^* = \alpha Q_t \tag{5}$$

Therefore, the corresponding distributed lag function for each firm may be written:

$$I_t = a + \alpha Y_0[Q_t - Q_{t-1}] + \alpha Y_1[Q_{t-1} - Q_{t-2}] + \ldots - W_1[I_{t-1} - \delta K_{t-1}] - \ldots + \delta K_t + \varepsilon_t \tag{24}$$

For each firm, the form of the distributed lag function with the minimum regression standard error would be determined. The constraints on lagged terms correspond to those discussed in the consideration of the above homogeneity tests. Next, a dummy variable, TC, would be stipulated for each firm. This variable would represent the existence (or non-existence) of the ITC at any point in time. The criterion for existence of the ITC in any period would be its legislative availability for six months or more during that period. For each firm, TC would assume a value of 1 during those periods in which the ITC was available and -0- during those periods in which there was no ITC. Further, the above characterization of the dummy variable should not be confused with the use of such variables to stratify data from firms in a cross-sectional application. The latter approach is not relevant to the current time series study. The form of the distributed lag function, including TC, with the minimum standard error would then be determined.

The effects, if any, of the ITC could be isolated by examining the following:

(1) Number of equations in which TC enters.

(2) Relative sizes of the coefficients of TC (scaled by their standard errors) between sub-groups.

Each possibility will be considered in turn.

NUMBER OF EQUATIONS IN WHICH TC ENTERS

As stated above, each model would be executed with TC excluded and then included, for each firm. If the inclusion of TC lowers the standard error of the regression equation, TC would be incorporated in the model. A comparisen would be drawn between the two sub-groups (flow-through and deferred) on the number of models in which TC enters. Seemingly, if TC behaves markedly differently in one sub-group than in the other, support would be lent to rejection of the study hypothesis. By contrast, if the behavior is similar, support would be lent to the acceptance of the hypothesis.

Although interesting, the above test would provide little basis for a quantitative conclusion concerning the inter-group comparative effects (if any) of the ITC as manifested by the coefficients of TC. Therefore, additional tests would be utilized in the examination of the results of adding a dummy variable for ITC to the output definition of desired capital. Such tests are discussed below.

If the existence (or non-existence) of the influence of the ITC impacted upon the investment behavior of the sample firms, the level of such impact would be evident in the values of the coefficient for TC. However, these values should not be considered in isolation. The

significance of the sample coefficient is determined by the relationship of the value of that coefficient to its standard error. The larger the ratio,

$$\left(\frac{\text{coefficient}}{\text{standard error}} \right)$$

the greater the significance of the coefficient. Thus, in order to address the relative levels of impact of the ITC between accounting sub-groups and the significance of the corresponding measures, the values of the coefficients could be scaled by their standard errors in the performance of the tests discussed in the succeeding paragraphs. However, such scaling could impact upon the comparability of coefficients between firms, as discussed below.

The scaled coefficients would correspond to values of student t-statistics under the null hypothesis that the population coefficients for the dummy variables equal zero. A strict comparison of these scaled coefficients between firms, of course, would be affected by differing degrees of freedom relevant to each scaled value. These differences would result from diversity in the number of parameters within the regression models. In evaluating the results of comparisons of the scaled coefficients, the reader should be aware that different numbers of model parameters would bias the results toward non-comparability.

Prerequisite to the determination of the appropriate tests of the coefficients was consideration of the relationship (if any) of the two sample sub-groups. As will be discussed in the next chapter, the sampling design indicated matching of firms by industry classification and size within the industry. If this attempt was successful, the assumption would be that extraneous factors were controlled and matched pairs of firms (one for each accounting method) were generated. According to Siegel,[24] a powerful non-parametric statistical test for matched pairs would be the randomization test. The null hypothesis would posit that the elements of one group in the pair were not significantly different in size to the elements of the other group. Since the essence of the study hypothesis was that the ITC did not impact differently (as measured by the scaled coefficients) upon accounting sub-groups, the randomization test would be relevant under the assumption of matched pairs. The specific procedures of this test are outlined below:

> For each pair of firms (one deferred and one flow-through), the difference in scaled coefficients would be computed. These differences would then be summed. Next, the number of possible outcomes (summed differences) would be determined. The number of

---

[24] Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (McGraw Hill, 1956), pp. 93-94.

possible summed differences would equal 2^N, where N = the number of pairs of firms. The level of significance for the test, α, would then be specified. This level would be applied to the number of possible summed differences ($\alpha \cdot 2^N$) to generate the number of possible outcomes which would fall in the rejection region for the null hypothesis. Then, since the test herein would be two-tailed, the $\frac{\alpha}{2} \cdot 2^N$ largest possible sums of observed differences would be determined. The occurrence of all positive observed differences would generate the result with the largest sum; the occurrence with all but the smallest observed difference being positive would represent the next largest, and so on. This tabulation would continue until the $\frac{\alpha}{2} \cdot 2^N$ such differences have been enumerated. The last of such "largest sums" would establish the positive "rejection value." An analogous procedure would be applied to determine the negative "rejection value." Finally, the sum of differences corresponding to the actual outcome would be examined to ascertain its size relative to the "rejection values."

The above test would provide valuable information if the pairs were indeed effectively matched. What if they were not? The randomization test could be reapplied, in an adapted fashion, to the sub-groups viewed as independent samples. This re-application would allow consideration of the study hypothesis under either dichotomous assumption regarding matched pairs. Implicit in the performance of this test would be the assumption that the non-random sampling technique did not bias the results of the test. The adapted techniques are discussed below:

In order to test for equality of means between the observations in the independent samples, differences in summed observations between samples would be considered. The number of possible outcomes, representing differences between sub-groups of sums of scaled coefficients, would equal

$$\left(\frac{n_1 + n_2}{n_2} \right) \quad \text{where}$$

n_1 = number of deferred firms

n_2 = number of flow-through firms.

Again, the level of significance would be specified and the number of rejection values (differences of sums) determined, as $[\alpha \cdot (\frac{n_1+n_2}{n_2})]$.

The number of possible rejection outcomes increases dramatically with increases in sample size. If this number becomes cumbersome, an approximation could be accomplished through use of the following t-statistic.[25]

$$t = \frac{\bar{D} - \bar{F}}{\sqrt{\frac{(D-\bar{D})^2 + (F-\bar{F})^2}{n_1 + n_2 - 2} \cdot \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}}$$

where:

$\bar{D}$ = mean of deferred scaled coefficients

D = deferred scaled coefficients

$\bar{F}$ = mean of flow-through scaled coefficients

F = flow-through scaled coefficients

The above approximation applies when the ratio of n_1 to n_2 lies between 1/5 and 5 and the degree of "peakedness" (kurtosis) of the combined samples is small. The test for kurtosis would be performed based upon computed scaled coefficients. In the event of a large kurtosis, a similar test, the Mann-Whitney U-Test, could be applied.

---

[25] Ibid, p.155.

Finally, a methodological suggestion for future researchers is offerred. The scaled coefficients correspond to values of a t-distribution. This distribution could be divided into regions, or cells, and frequencies of observed and expected occurrences could be determined. This testing procedure would generate chi-square statistics for each sub-group. The ratio of these statistics would represent the powerful, parametric F-ratio. Unfortunately, two conditions for application of this test are that no cell contain less than one observation and that no more than 20% of the cells contain less than 5 observations. As will be demonstrated in the next chapter, the current sample size precluded application of this test in this study.

The methods for sample selection, data collection, and measurement are considered in depth in the succeeding chapter.

CHAPTER 3

SAMPLE SELECTION, DATA COLLECTION, AND MEASUREMENT

This chapter addresses the problems of selection of the sample firms, collection of the raw data, and measurement of the components of the relevant variables necessary to implement the neoclassical model. Reiterating, the examination focuses on two sub-groups: those consistently utilizing the flow-through method and those utilizing the deferred method.

Admittedly, generalization of the results of this study would suffer from a non-random sampling plan. However, the disproportionate share of investment expenditures executed by large firms seemed to dictate concentration upon their investment behavior. Jorgenson and Siebert reached a similar conclusion in designing their sampling plan.[1] A pragmatic justification for concentration upon large firms derives from the availability (or unavailability) of required data.

However, to provide some basis for generalization of the results, firms were selected from a cross-section of industries. The initial procedure in selection

---

[1]Jorgenson and Siebert, "Comparison of Alternative Theories," pp. 691-2.

of individual firms consisted of enumerating the largest (usually five) firms in each such industry. Business Week publishes quarterly results for the largest firms in the major industries. One such issue was consulted,[2] and the largest firms (based upon quarterly sales) from selected industries were isolated for examination.

The industries considered are listed in Table 3-1 below:

TABLE 3-1 SAMPLE INDUSTRIES

1. Aerospace	17. Office Equipment, Computers
2. Appliances	18. Oil Service and Supply
3. Automotive	19. Paper
4. Beverages	20. Personal Care Products
5. Building Materials	21. Publishing
6. Chemicals	22. Radio and TV Broadcasting
7. Containers	23. Railroads
8. Drugs	24. Retailing (food)
9. Electrical, Electronics	25. Retailing (non-food)
10. Food Processing	26. Service Industries
11. General Machinery	27. Special Machinery
12. Instruments	28. Steel
13. Leisure Time Industries	29. Textiles and Apparel
14. Metals and Mining	30. Tire and Rubber
15. Miscellaneous Manufacturing	31. Tobacco
16. Natural Resources	32. Trucking

For each of the potential sample firms from the above industries, the most recently available annual report to shareholders was consulted to determine the

[2] Business Week, 8/10/74, pp. 72-92.

method of accounting for the ITC. An overwhelming majority were found to be utilizing the flow-through method. However, approximately twelve percent reported using the deferred method. Each of these firms is presented in Table 3-2.

TABLE 3-2 DEFERRED FIRMS

Number	Firm	Industry
1	United Aircraft	Aerospace
2	Bendix	Automotive
3	Schlitz	Beverages
4	N.L. Industries	Misc. Manufacturing
5	Boeing	Aerospace
6	General Motors	Automotive
7	Ford	Automotive
8	Anheuser-Busch	Beverages
9	DuPont	Chemicals
10	Union-Carbide	Chemicals
11	Johnson & Johnson	Drugs
12	RCA	Electrical, Electronics
13	Beatrice Foods	Food Processing
14	Combustion Engineering	General Machinery
15	Borg-Warner	Misc. Manufacturing
16	IBM	Office Equipment, Computers
17	Xerox	Office Equipment, Computers
18	Great Atlantic & Pacific Tea Co.	Retailing (food)
19	General Electric	Electrical, Electronics
20	Chrysler	Automotive
21	Texas Instruments	Electrical, Electronics

It should be noted that firms from some industries were purposely omitted from consideration. Utilities, due to the implications of accounting for rate-

setting purposes, were specifically excluded. Further, since airline companies face a unique, lease-based, investment program, they were also excluded.

The final sample of deferred firms consisted of a subset of those candidates enumerated in Table 3-2. Data unavailability and non-continuous application of the deferred method of accounting for the ITC necessitated such a sample size reduction. For each of the firms listed in Table 3-2, Moody's Industrial Manual[3] was consulted to ascertain data availability. Next, previous years' annual reports to shareholders and to the Securities and Exchange Commission [SEC] [FORM 10-K] were examined to determine if the deferred method had been consistently used since 1963 by each firm. Finally, with the exception of AUTOMOTIVE, only the largest remaining firm in any industry was retained in the study. Without this last constraint, a disproportionate emphasis would have fallen on firms from a few industries, thus reducing the generality of the study.

These procedures eliminated many sample candidates. The remaining eight are presented in Table 3-3.

---

[3]Moody's Industrial Manual (New York) , various annual issues.

TABLE 3-3 SAMPLE DEFERRED FIRMS

Number	Firm	Industry
1	Beatrice Foods	Food Processing
2	Boeing	Aerospace
3	Combustion-Engineering	General Machinery
4	DuPont	Chemical
5	Ford	Automotive
6	General Electric	Electrical, Electronics
7	General Motors	Automotive
8	Great Atlantic & Pacific Tea Co.	Retailing (food)

As alluded to in the preceding chapter, selection of the members of the two sub-groups in a manner which isolated ONLY accounting for the ITC presented serious problems. Unknown systematic bias may well be present. Nevertheless, the matching of industries for each sub-group would seemingly contribute to the isolation of the accounting factor.

Therefore, the sampling plan for the flow-through firms consisted of selection of the firm (two in the case of AUTOMOTIVE) most similar in size within the industry group to the sample deferred firm(s). Again data availability and consistency of accounting method were considered. It was noted that virtually all such firms changed to the flow-through method in 1964. This change followed enactment of the Revenue Act of 1964, which removed the condition that tax

deductible depreciation be reduced by the amount of ITC.

Further, in 1964 the Accounting Principles Board issued its Opinion No. 4 which permitted for the first time use of the flow-through method. Since 1964, each sample firm has consistently utilized the flow-through method. The effect of the change in accounting method in 1964 upon the current study is considered in the next chapter, on empirical results. The sample flow-through firms are presented in Table 3-4.

TABLE 3-4 SAMPLE FLOW-THROUGH FIRMS

Number	Firm	Industry
1	Babcock & Wilson	General Machinery
2	Dow	Chemical
3	International Harvester	Automotive
4	Kraft Co.	Food Processing
5	Northrop	Aerospace
6	Safeway	Retailing (food)
7	TRW	Automotive
8	Westinghouse	Electrical,Electronics

Reiterating, for each sample firm presented in Tables 3-3 and 3-4 above a distributed lag function was fitted to depict the relationship between changes in desired capital and investment expenditures. The final form of this equation appears as follows:

$$I_t = a + \alpha Y_0 \left[\frac{P_t Q_t}{C_t} - \frac{P_{t-1} Q_{t-1}}{C_{t-1}}\right]$$

$$+ \alpha Y_1 \left[\frac{P_{t-1} Q_{t-1}}{C_{t-1}} - \frac{P_{t-2} Q_{t-2}}{C_{t-2}}\right] + \ldots \qquad (23)$$

$$- W_1[I_{t-1} - \delta K_{t-1}] - W_2[I_{t-2} - \delta K_{t-2}]$$

$$- \ldots + \delta K_t + \varepsilon_t.$$

The collection of raw data and definition and measurement of the variables in the above neoclassical model are inextricably linked and, therefore, are considered jointly. Each variable is considered in turn in the succeeding paragraphs, and, unless otherwise stated, coincides in all material respects as to definition and measurement with those utilized by Jorgenson and Siebert.[4]

The dependent variable, I_t was defined as gross investment in plant and equipment, expressed in constant dollars. Investment in current dollars is presented in Moody's,[5] under "additions at cost." This figure was deflated by the investment goods price index, q_t, which was defined as the wholesale price

---

[4]Jorgenson and Siebert, "A Comparison of Alternative Theories of Corporate Investment," and "Optimal Capital Accumulation and Corporate Investment Behavior,"

[5]Moody's Industrial Manual, various annual issues.

level applicable to machinery and equipment as a group. This index is published in the Survey of Current Business[6] and the accompanying Business Statistics supplement.[7]

The definition of the I_t variable was established in light of the impact of accounting for the ITC. Although the ITC is available only on the acquisition of ELIGIBLE[8] machinery and equipment, additions at cost were

---

[6]U.S. Department of Commerce, Bureau of Economic Analysis. Survey of Current Business, various monthly issues.

[7]U.S. Department of Commerce, Office of Business Economics, Business Statistics: A Supplement to the Survey of Current Business, 1971.

[8]See Section 38 and Section 48 of Complete Internal Revenue Code of 1954, January 1, 1974, published by Prentice-Hall, Inc. According to Section 48, "eligible" property means:

A. Tangible personal property or

B. Other tangible property (not including a building and its structural components) but only if such property:

(i) is used as an integral part of manufacturing, production, or extraction, or of furnishing transportation, communications, electrical energy, gas, water, or sewage disposal services, or

(ii) constitutes a research facility used in connection with any of the activities referred to in clause (i), or

(iii) constitutes a facility used in connection with any of the activities referred to in clause (i) for the bulk storage of fungible commodities (including commodities in a liquid or gaseous state), or

C. Elevators and escalators, but only if

(i) the construction, reconstruction, or erection of the elevator or escalator is completed by the taxpayer after June 30, 1963, or

(ii) the elevator or escalator is acquired after June 30, 1963, and the original use of such elevator or escalator commences with the taxpayer and commences after such date.

It is interesting to note that under recent court decisions the above definitions have been interpreted to include such expenditures as ski lifts and railroad rock beds.

not disaggregated to eligible and ineligible portions. The justification for this approach lies in the supposition that the acquisition of eligible machinery might well require the purchase of ineligible supportive facilities.

Contrarily, the assets of companies merged into the sample companies, which had the effect of increasing consolidated property, were not included in I_t. The decision to acquire another company affects the entire corporate structure. The impact of the ITC on such a decision would be indirect, if at all. In the case of the acquisition of supportive facilities, however, the essence of the decision concerns the asset composition of the existent company. The availability of the ITC might well impact upon that decision.

The discussion concerning I_t would be remiss without mention of a potential left-out element: assets "acquired" through lease arrangements. Under generally accepted accounting principles, as in effect during the sample period, sizable lease agreements would likely NOT be included in the property or investment measures. The conclusions of this study must be considered in light of the knowledge that lease effects were not included in the analysis.

The next variable considered represents the numerator in the neoclassical proxy of desired capital: output in current dollars, P_tQ_t. This measure was

defined as recorded cost of goods sold plus (or minus) the change in inventory levels.[9] Output in constant dollars, Q_t, would become a relevant factor in the event of performance of the supplemental tests described in the preceding chapter.[10]

To derive output in constant dollars Q_t, current dollar output P_tQ_t was divided by P_t, the price deflator. P_t was measured by the wholesale price index applicable to the firm's industry group and is published in Wholesale Prices and Price Indexes [11] and the Handbook of Labor Statistics.[12]

Measurement of the price of capital services, C_t, the denominator in the neoclassical definition of desired capital will be discussed in depth in a subsequent section of this chapter.

---

[9] The model as developed by Jorgenson & Siebert defined P_tQ_t as sales $\pm$ change in inventory. This definition compared a component containing a profit element (sales) with one valued at cost (inventory). To remove this measurement inconsistency, the P_tQ_t term was re-defined as cost of goods sold $\pm$ change in inventory.

[10] It should be recalled that desired capital could be re-defined in terms of Q_t. A dummy variable for the existence (or non-existence) of the ITC would be stipulated. The inter-group comparative effects of this dummy variable could be isolated through examination of the relative scaled coefficients applicable thereto.

[11] U.S. Department of Labor, Bureau of Labor Statistics, Wholesale Prices and Price Indexes, various issues.

[12] U.S. Department of Labor, Bureau of Labor Statistics, Handbook of Labor Statistics, 1973, pp. 311-320.

The variable depicting net investment expenditures, $I_t - \delta K_t$, was defined as the change in net capital stock. The measurement of periodic net capital stock was critical to the determination of net investment. Jorgenson and Siebert noted, concerning such measurement:

> Calculation of capital stock by the perpetual inventory method was not feasible. The method we employed was to select an initial and terminal date of net capital stock from each firm's balance sheet reports. These benchmark figures were deflated ... These deflated stock figures were interpolated by gross investment, in constant prices, resulting in capital stock values for each year and an estimate of replacement in constant prices for each year. 13

This approach would be represented algebraically as follows:

$$\Delta K_t = \frac{I_t}{\sum_{t=1}^{n} I_t} (K_n - K_1), \text{ all in constant dollars.}$$

Conditional upon $K_n > K_1$, ΔK_t would always be positive. If, in reality, ΔK_t were negative for a given period, this situation would be ignored in the overall smoothing process.

---

[13] Jorgenson and Siebert, "Comparison of Alternative Theories," pp. 693-694.

The desirability of such smoothing must be considered in light of the theory of replacement, discussed in the preceding chapter. In this theory, again, replacement investment in each period is equal to a constant proportion of beginning net capital stock. As indicated by footnote 10 in the preceding chapter, the assumption of constant proportionality of replacement and capital stock derives theoretical support in a condition where capital stock is constant or growing at a constant rate (in a probabilistic sense). The Jorgenson and Siebert approach seemingly attempts to capture at least the essence of this theoretical condition. Therefore, this approach was utilized in the current study.

The validity of the periodic values assigned to net capital stock was contingent upon the reasonableness of the estimates of beginning and ending net capital stock, in constant dollars. These estimates required an assumption regarding acquisition dates of the firm's assets. For another purpose (to be discussed later), the average life of each firm's depreciable assets was computed. For consistency and simplicity, the deflator, q_t, was applied as of life/2 periods preceding the beginning date (beginning of 1959) and ending date (end of 1973).

Application of the above procedures resulted in

estimates for annual net investment, $I_t - \delta K_t$, and balances of net capital stock, K_t, both in constant dollars. Replacement investment, R_t, was defined as the difference between gross investment, in constant dollars, I_t, and net investment, in constant dollars, $I_t - \delta K_t$. It should be noted that an estimate of δ was generated for each firm, by the regression models. However, in order to implement the models, an a priori estimate of δK_t was necessary. This estimate was provided through the computation of R_t.

The final factor considered, the price of capital services, C_t, consists of the following elements:

$$C_t = \frac{q_t\, r_t}{(1-u_t)} + \frac{q_t\, R_t}{(1-u_t)K_1} - \frac{u_t CCA + ITC}{(1-u_t)K_1} - \frac{\dot{q}_t}{(1-u_t)} \qquad (25)$$

where:

u_t = tax rate = $\frac{\text{Profits before taxes-profits after taxes}}{\text{Profits before taxes}}$

q_t = investment goods price index

CCA = recorded depreciation

$$r_t = \frac{PAT + CCA - q_t R_t + \dot{q}_1 K_1 + \dot{q}_2 K_2 + \dot{q}_3 K_3}{VTA} \qquad (26)$$

where:

K_1 = depreciable assets

K_2 = depletable assets

K_3 = inventories

PAT = recorded profits after taxes

VTA = value of total assets $\mp$ market value of the firm's securities at the beginning of the period.

K_2 (depletable assets) and K_3 (inventories) effectively disappear from the r_t of the sample firms. No such firm maintained a significant stock of depletable assets. Inventories would be relevant only under the LIFO method, where holding gains on the base stock could go unrecorded. No selected firm materially utilized the LIFO method. The values of PAT (profits after taxes) and CCA (depreciation) were drawn from Moody's.[14]

At this juncture, a review of the elements of r_t, cost of capital, revealed two areas of definitional inconsistency: PAT were based upon current and historical accounting measures whereas VTA (value of total assets) as defined, captured expectational factors; replacement cost depreciation, as defined ($q_t R_t$), considered only actual replacement expenditures. The procedures adopted to remove the inconsistencies and to provide an internally

---

[14] Moody's Industrial Manual, various annual issues.

consistent measure of r_t are considered in the succeeding paragraphs, beginning with the PAT/VTA element.

The value of total assets, VTA, was redefined as the recorded book value of total equities. This altered definition caused the numerator and denominator to be measured from a similar time perspective, capturing only current and historical events. The alternative approach, measuring expected earnings for the numerator, was not feasible due to the unavailability of relevant data. The next section details the techniques implemented to remove the inconsistency regarding current cost depreciation.

For each firm, the beginning gross book value of capital stock was drawn from Moody's[15] for each year from 1959 to 1973 inclusive. This annual amount was divided by periodic recorded depreciation, resulting in an estimate of the average life of property for each year. The arithmetic mean of these lives was then computed (for each firm) to yield an overall estimate of the average life of property over the sample period.

An assumption concerning acquisition dates of such property was requisite to the measurement of current cost depreciation. For consistency and simplicity, current cost depreciation was computed as if the applicable assets

---

[15] Ibid., various issues.

had all been acquired life/2 periods preceding. The resultant measure, depreciation in constant dollars, was adjusted for the actual price level, q_t, existent in each period. Algebraically, the computation of current cost depreciation would appear as follows:

$$\left[\frac{CCA}{q_t\text{-life/2}} \times q_t \right]$$

The measurement of each element of C_t, with one exception, has been discussed. ITC represents the amount of investment tax credit earned on acquisitions during each period from 1962 to 1973 (inclusive). Annual reports to shareholders or the SEC [FORM 10-K] were consulted for each year. Many firms reported ITC earned in one of the above sources. However, some did not disclose such information. As a result, letters requesting this information were sent to a financial officer of each non-disclosure firm. Further, to test for possible netting in reported ITC, similar letters were sent to all disclosure firms.

The return rate was as follows:

	DISCLOSURE	NON-DISCLOSURE [16]
SENT	8	8
RETURNED	6	7
RATE	75%	87.5%

[16] For two firms which did not furnish the requested data, Beatrice and Combustion-Engineering, the

The information returned by disclosure firms did not differ materially from that reported. It should be noted in passing, however, that small intra-firm differences might exist due to the method of combining domestic and foreign investment tax credits and the method of recording recaptured investment tax credits. (Such recapture occurs when an asset is disposed of prematurely.)

The raw data generated by the above procedures is presented, for each firm, in the Appendix. The amount of ITC earned is intentionally omitted. This decision was prompted by the desire to protect the confidentiality of data received directly by the author from sample firms.

Compilation of the input variables to the neoclassical model was performed, for each firm, based upon the above definitions. The distributed lag function, for each firm, was then generated. The resultant form, with the minimum regression standard error, is presented in Table 3-5.

The coefficients for changes in desired capital were negative in most instances. This result is at

---

amount of ITC earned in each period was approximated as indicated below. For each firm, net change in the deferred ITC account was presented for some of the sample periods. The percentage of this amount to gross investment in current dollars, for those years, was determined. An average derived from these percentages was applied to gross investment in current dollars for each sample year, yielding an estimate of ITC earned.

TABLE 3-5

FITTED NEOCLASSICAL MODEL COEFFICIENTS, DEFINITION OF C_t UNREVISED, DEFERRED FIRMS 1963-1973

Firm	a	$(\frac{P_tQ_t}{C_t} - \frac{P_{t-1}Q_{t-1}}{C_{t-1}})$	$(\frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \frac{P_{t-2}Q_{t-2}}{C_{t-2}})$	$(\frac{P_{t-2}Q_{t-2}}{C_{t-2}} - \frac{P_{t-3}Q_{t-3}}{C_{t-3}})$	$(\frac{P_{t-3}Q_{t-3}}{C_{t-3}} - \frac{P_{t-4}Q_{t-4}}{C_{t-4}})$	$(I_{t-1} - \delta K_{t-1})$	$(I_{t-2} - \delta K_{t-2})$	K_t	Corrected R^2	SE
Beatrice	-31.524	-.0204	-.0136	.0021	-.0212	1.0432	1.5583	.2195	.977	4.363
Boeing	The generated C_t's for this period included two negative values and two values larger than 1. Therefore, a logical expression of this model was precluded.									
Combustion-Engineering	9.8727	-.0039	.0004	——	——	.9949	.5075	-.0074	.936	2.665
DuPont	125.06	-.0920	-.0337	.0640	——	3.2651	3.1825	-.1628	.737	45.846
Ford	296.27	.0098	-.0047	——	——	4.5547	-3.4803	.1028	.848	61.662
General Electric	13.005	-.0137	——	——	——	4.7894	-1.7920	.0593	.858	57.901
General Motors	-938.38	-.0825	-.0651	——	——	8.6370	6.0270	.2165	.834	111.87
Great A&P	67.893	-.0009	-.0003	-.0006	——	——	——	-.0150	.732	4.484

TABLE 3-5

FITTED NEOCLASSICAL MODEL COEFFICIENTS, DEFINITION OF C_t UNREVISED, FLOW-THROUGH FIRMS 1963-1973

Firm	a	$\left(\frac{P_tQ_t}{C_t} - \frac{P_{t-1}Q_{t-1}}{C_{t-1}}\right)$	$\left(\frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \frac{P_{t-2}Q_{t-2}}{C_{t-2}}\right)$	$\left(\frac{P_{t-2}Q_{t-2}}{C_{t-2}} - \frac{P_{t-3}Q_{t-3}}{C_{t-3}}\right)$	$\left(\frac{P_{t-3}Q_{t-3}}{C_{t-3}} - \frac{P_{t-4}Q_{t-4}}{C_{t-4}}\right)$	$(I_{t-1}-\delta K_{t-1})$	$(I_{t-2}-\delta K_{t-2})$	K_t	Corrected R^2	SE
Babcock-Wilcox	-90.555	-.0016	-.0019	-.0044	-.0071	-.2810	-3.9234	.9878	.993	.868
Dow	-63.923	-.0423	-.0213	———	———	3.4163	———	.0780	.782	37.666
Intern'tl Harvester	-138.03	-.0028	-.0034	-.0036	-.0038	———	———	.4497	.678	10.877
Kraftco	-51.150	-.0058	———	———	———	6.0700	———	.1358	.933	3.237
Northrop	7.6949	-.0015	———	———	———	———	———	.1283	.230	4.420
Safeway	-57.315	-.0246	-.0160	———	———	5.0622	5.5197	-.0184	.978	4.339
TRW	-16.245	-.0074	.0006	-.0018	———	3.6830	-2.6657	.1748	.932	5.384
Westinghouse	10.238	-.0011	-.0010	-.0014	-.0008	.0641	1.5556	.0404	.857	20.103

variance with the theory that an increase in the desired stock of capital will generate positive investment expenditures. Two possible explanations which could be offered for the behavior manifested are: the theory is empirically unsupportable, or the independent variables have been measured with error. As previously mentioned, the theory has been empirically tested and supported in several applications.[17] The decision was reached to rely on the validity of these studies. Therefore, the assumption was made that the measurement of the independent variables contained errors. The amount of bias introduced by this error was indeterminate. However, an assumption regarding the direction of bias was appropriate. When independent variables are measured with error, and the error is uncorrelated with measurement errors in the dependent variable, the regression coefficients are biased downward in absolute value.[18]

In order to detect and minimize measurement errors in the independent variables, the measures as previously defined were closely scrutinized. Two redefinitions evolved from this scrutiny, both involving elements of C_t.

---

[17] Jorgenson and Siebert, "Comparison of Alternative Theories," and Jorgenson and Stephenson, "Investment Behavior."

[18] Rao and Miller, p. 181. For an excellent discussion of errors in measurement of independent variables, see Rao and Miller, pp. 179-184; also H. Theil, Economic Forecasts and Policy (Amsterdam: North-Holland Publishing Co., 1958), pp. 148-161, 327-329.

The rate of return element of C_t for a firm, r_t, is commonly defined as:

$$r_t = \text{Real Rate}_t + \dot{p}^{\ell} + f(\text{RISK} + \text{TRANSACTION COSTS})$$

where:

$\dot{p}^{\ell}$ captures anticipated inflationary effects.

A frequently used measure of the (Real $\text{Rate}_t + \dot{p}^{\ell}$) is the rate on U.S. Treasury Bills (T-Bills). Ignoring transaction costs, the difference between a firm's rate of return and the T-Bill rate is the risk factor. Assuming a constant mean risk factor over the sample period, the periodic measurement of r_t would be improved by elimination of stochastic fluctuations in observed risk. This assumption was adopted. Therefore, a revised measure of r_t was computed as follows:

$$\text{Revised } r_t = \text{T-Bill rate}_t \times \frac{\text{Geometric Mean of Original } r_t}{\text{Geometric Mean of T-Bill Rate}}$$

The geometric means represent the period from 1959 to 1973 inclusive. The T-Bill rate is published in Business Conditions Digest.[19]

---

[19] U.S. Department of Commerce, Business Conditions Digest, various annual issues.

A further adjustment involved the replacement rate component of C_t:

$$\frac{q_t R_t}{(1-u_t)K_1}.$$

The numerator, $q_t R_t$, measured only ACTUAL replacement expenditures. A more reasonable approximation of the rate to replace expiring assets would seemingly capture current dollar depreciation. This measure is not contingent upon the somewhat unrelated decision to effect an expenditure on assets, as is $q_t R_t$. Therefore, the revised definition for the numerator of the replacement rate, discussed above,

$$\left[\frac{CCA}{q_t - life/2} \cdot q_t \right],$$

was substituted for $q_t R_t$ in the definition of C_t. It should be recalled that a similar substitution was incorporated in the original definition of r_t.

The above redefinitions improved the conformity of the generated models to the neoclassical theory as evidenced by the existence of positive signed coefficients in many instances. These results are considered in detail in the next chapter: Empirical Results.

CHAPTER 4

EMPIRICAL RESULTS

The preceding two chapters considered the research design and data collection techniques of this study. The current chapter examines the results of application of the various quantitative models to the data from the sample sub-groups. The results of the initial application, including the neoclassical model variables as originally defined, were presented in the preceding chapter in Table 3-5.

Reiterating, the investment models, as first fitted, were largely at variance with the neoclassical theory, as indicated by the direction of the signs of the regression coefficients. A subsequent review of how the model's component variables were measured revealed two areas where improvement seemed warranted: cost of capital and rate of replacement. It should be recalled that the revised measure of the cost of capital was based upon the ratio of the geometric mean of the computed r_t's to the geometric mean of the riskless Treasury bill rate. Further, the rate of replacement was redefined to include

current dollar depreciation approximately as follows:

$$\left[\frac{CCA}{q_t\text{-life/2}} \cdot q_t \right]$$

where:

CCA = recorded depreciation

q_t = investment goods price index

life/2 = one-half the computed average life of the firm's capital assets.

Such redefinitions were incorporated into the structural variables and the neoclassical model was refitted to the data. The resulting minimum standard error equations for each firm, along with the regression standard error, R^2, corrected for degrees of freedom, are presented in Table 4-1.

A review of the results indicated that the application of the redefined variables created a dichotomous situation. In the models with redefined variables, the regression standard errors generally increased as did the incidence of equations in which no desired capital terms entered the minimum standard error form. Contrarily, an improvement in sign direction, a measure of the conformity of the results to the theory, was manifested. The improved theoretical justification of the results,

TABLE 4-1 FITTED NEOCLASSICAL MODEL COEFFICIENTS, DEFINITION OF C_t REVISED, FLOW-THROUGH FIRMS 1963-1973

Firm	a	$\frac{P_tQ_t - P_{t-1}Q_{t-1}}{C_t \quad C_{t-1}}$	$\frac{P_{t-1}Q_{t-1} - P_{t-2}Q_{t-2}}{C_{t-1} \quad C_{t-2}}$	$\frac{P_{t-2}Q_{t-2} - P_{t-3}Q_{t-3}}{C_{t-2} \quad C_{t-3}}$	$\frac{P_{t-3}Q_{t-3} - P_{t-4}Q_{t-4}}{C_{t-3} \quad C_{t-4}}$	$I_{t-1} - K_{t-1}$	$I_{t-2} - K_{t-2}$	K_t	Corrected R^2	SE
BABCOCK-WILCOX	4.9513	.0093	.0154	.0137		- .8109	-1.7229	.2133	.682	5.451
DOW	-74.818					1.5563	-2.2837	.3060	.523	46.641
INTERNATIONAL-HARVESTER	183.31					2.5195		-.2170	.136	17.812
KRAFTCO	-102.41	-.0010	.0015	-.0064		2.2696		.3079	.758	6.116
NORTHROP	14.122							.0058	--0--	5.307
SAFEWAY	4.8707	.0151	.0029	.0236	.0080	-4.1753	-10.438	.9642	.980	4.194
TRW	1.0740					1.0257		.0973	.732	10.656
WESTINGHOUSE	-1.4641	.0033	.0092	.0023	.0081	1.1620		.0409	.720	28.025

TABLE 4-1

FITTED NEOCLASSICAL MODEL COEFFICIENTS, DEFINITION OF C_t REVISED, DEFERRED FIRMS 1963-1973

Firm	a	$\frac{P_tQ_t - P_{t-1}Q_{t-1}}{C_t \quad C_{t-1}}$	$\frac{P_{t-1}Q_{t-1} - P_{t-2}Q_{t-2}}{C_{t-1} \quad C_{t-2}}$	$\frac{P_{t-2}Q_{t-2} - P_{t-3}Q_{t-3}}{C_{t-2} \quad C_{t-3}}$	$\frac{P_{t-3}Q_{t-3} - P_{t-4}Q_{t-4}}{C_{t-3} \quad C_{t-4}}$	$I_{t-1} - K_{t-1}$	$I_{t-2} - K_{t-2}$	K_t	Corrected R^2	SE
BEATRICE	-12.461	-.0351	.0067	-.0530				.4443	.850	11.030
BOEING	111.19	-.0275				11.162	-11.104	-.0444	.587	63.539
COMBUSTION ENG.	-11.710	.0091	.0042	.0084	.0119	.1176	-1.1702	.2732	.880	3.685
DU PONT	-2.1171	.1290	-.0245	.1234	.1792			.2062	.516	62.178
FORD	218.35	-.0111				5.1211	-3.9274	.1281	.702	86.150
GEN. EL.	-347.83	-.0183	-.0008	-.0247	.0515	5.3460	-4.9165	.4403	.983	19.773
GEN. MOTORS	1770.20					4.7859		-.1354	.044	268.37
GREAT A&P	111.62	-.0003	-.0016					-.175-	.564	5.720

accompanied by the seemingly more reasonable variable definitions, dictated utilization of the revised models for testing the study hypothesis.[1]

Another relevant question encountered concerned the appropriate sample period. As previously mentioned, each sample flow-through firm utilized some form of the deferred method for the years 1962 and 1963. A meaningful comparison of investment parameters between flow-through and deferred sub-groups was predicated upon consistent application of the ITC reporting method within each sub-group over the entire sample period. The absence of such a condition would negate the attempt to isolate the effects, if any, of accounting for the ITC. Therefore, to provide the requisite reporting consistency, the year 1963 was eliminated from the current test. The neoclassi-

---

[1]It should be noted that the neoclassical model has not gone unchallenged. According to J.W. Elliott, "Theories of Corporate Investment Behavior Revisited," American Economic Review, March 1973, Vol. 63, pp. 195-207: "... the major conclusion of the [Jorgenson-Siebert] study that the neoclassical model of investment is more effective than the other alternatives simply does not stand up to [our] enlarged test."

Further, in Robert Eisner and M.I. Nadiri, "Investment Behavior and Neo-Classical Theory," The Review of Economics and Statistics, August 1968, Vol. L, pp. 369-382, the following was concluded: "The role of relative prices, the critical element in the neoclassical approach, is not confirmed."

cal model was applied to the relevant data for the inclusive period 1964-1973 for each firm.

The resulting minimum standard error regression equations were analyzed as indicated in the succeeding paragraphs, in the performance of the basic test of the study hypothesis that investment behavior did NOT differ significantly between sub-groups. Initially, the test procedures are presented, followed by consideration of the results manifested in each sub-group.

It should be recalled that this test initially examines the relationship of the regression parameters WITHIN each sub-group. The F-statistic was utilized to test for homogeneity of these parameters. For the firms in each sub-group, the total of the sums of squared errors from each individual regression was compared to the total of the sums of squared errors from the master regression model. Again, in the master models, for each sub-group, the same coefficients were applied to the data from each firm. Reiterating, the master model coefficients for each sub-group were generated by applying one neoclassical model to the data, considered as a set of sample observations, from all firms in that sub-group. Next, the following adjustments were implemented in the master models, and the above test procedures repeated. First, individually fitted constants were included in

the otherwise master models. This adjustment seemed appropriate since the constant captured errors of omitted variables in individual regressions.[2] Such errors would likely vary between models. Further, in order to minimize the problem of relative scale between sample firms, the master regression models were executed utilizing individually fitted net capital stock coefficients, as well as constants.

If any of the above applications of the master model indicated coefficient homogeneity within each sub-group, a comparison of coefficients under that application between sub-groups would provide a statistically meaningful test of the study hypothesis. On the other hand, intra-group heterogeneity would negate the statistical significance of such an inter-group comparison.[3]

A conceptual interpretation of the condition of homogeneity would be as follows. In an homogeneous grouping of firms, the difference in the explanatory

---

[2]For an excellent discussion of this property of the constant in econometric studies see Rao and Miller, pp. 5-6.

[3]See the potential results table and accompanying discussion in Chapter 2, pp. 42-44.

ability of the master model and the individually fitted models would not be statistically significant. The condition of homogeneity relates to the total explanatory ability of the models, and, therefore, does not imply constancy of individual parameters across firms.

The results of the application of the above procedures to the firms in each sub-group are considered next, commencing with the flow-through category of firms.

Included in Table 4-2 are the minimum standard error regression equations for each flow-through firm for the inclusive period 1964-1973. The corrected R^2 statistics, regression standard errors, and Durbin-Watson statistics[4] are also presented therein. A review of the results indicates the diversity of equation forms. For some firms, such as Safeway, each possible independent variable entered the minimum standard error equation. For others, such as International Harvester and Northrop, only the constant

---

[4]The Durbin-Watson statistic is biased toward randomness due to the first difference nature of the distributed lag function. See Jorgenson and Stephenson, "Investment Behavior in U.S. Manufacturing, 1947-60," p. 190, for further discussion.

TABLE 4-2 FITTED NEOCLASSICAL MODEL COEFFICIENTS, DEFINITION OF C_t REVISED, FLOW-THROUGH FIRMS 1964-1973

Firm	a	$\frac{P_tQ_t - P_{t-1}Q_{t-1}}{C_t \quad C_{t-1}}$	$\frac{P_{t-1}Q_{t-1} - P_{t-2}Q_{t-2}}{C_{t-1} \quad C_{t-2}}$	$\frac{P_{t-2}Q_{t-2} - P_{t-3}Q_{t-3}}{C_{t-2} \quad C_{t-3}}$	$\frac{P_{t-3}Q_{t-3} - P_{t-4}Q_{t-4}}{C_{t-3} \quad C_{t-4}}$	$I_{t-1} - K_{t-1}$	$I_{t-2} - K_{t-2}$	K_t	Cor. R^2	SE	d
BABCOCK-WILCOX	2.8172	.0091	.0170	.0151		-1.0299	-1.6248	.2253	.643	6.053	2.220
DOW	177.04	-.0851	-.0380	-.0595	-.0798	.1047	-1.3976	.1995	.901	18.464	3.381
INTERN'L HARVESTER	305.98							-.3892	.232	16.651	2.079
KRAFTCO	-172.66	-.0015	.0027	-.0075				.4941	.833	5.220	2.720
NORTHROP	10.989							.0467	—0—	5.431	1.777
SAFEWAY	17.152	.0154	.0022	.0252	.0064	-3.8242	-11.626	.9723	.977	4.480	2.353
TRW	7.5755	.0057	-.0051	.0093		1.5845		.0152	.773	8.491	2.616
WESTINGHOUSE	49.549	.0041	.0087	.0050	.0067	.4350	1.3615	-.0478	.689	26.573	2.594

and net capital stock terms entered.[5] The computed F-statistics under all three specifications of the

---

[5]For each firm detailed herein, the minimum standard error model was rerun with time as a separate independent variable. The resulting equations, along with corrected R^2 and regression standard errors, are as follows:

INTERNATIONAL HARVESTER:

$$y = 864.38 - 1.5164\ K_1 + 11969 \text{ [case no]}$$

corrected $R^2 = .245$

SE = 17.411

NORTHROP:

$$y = 70.023 - 1.4901\ K_1 + 8.29 \text{ [case no]}$$

corrected $R^2 = .198$

SE = 4.635

SAFEWAY:

$$y = 463.73 + .0174\left(\frac{P_tQ_t}{C_t} - \frac{P_{t-1}Q_{t-1}}{C_{t-1}}\right)$$

$$+ .0017\left(\frac{P_{t-1}Q_{t-1}}{C_{t-1}} - \frac{P_{t-2}Q_{t-2}}{C_{t-2}}\right) + .0302\left(\frac{P_{t-2}Q_{t-2}}{C_{t-2}} - \frac{P_{t-3}Q_{t-3}}{C_{t-3}}\right)$$

$$+ .0068\left(\frac{P_{t-3}Q_{t-3}}{C_{t-3}} - \frac{P_{t-4}Q_{t-4}}{C_{t-4}}\right) - 1.403(I_{t-1} - \delta K_{t-1})$$

$$- 12.359(I_{t-2} - \delta K_{t-2}) - .6768\ K_1 + 30.913 \text{ [case no]}$$

corrected $R^2 = .955$

SE = 5.864

For the first two firms the time variable provided slight improvement; however, the improvement would not seem to justify the conclusion that time is a critical omitted variable. In fact, for International-Harvester the SE actually increased with the inclusion of the time factor. For Safeway, the inclusion of the time element weakened the model.

master model [all parameters, all parameters except constant, all parameters except constant and net capital stock coefficients] accompanied by supportive sums of squared errors, are presented in Tables 4-3A and 4-3B, as is the composition of the F-statistic. In each instance $F_{(ACTUAL)} > F_{CRITICAL(.05)}$, indicating intra-group heterogeneity. Further, to aid in visualization of this heterogeneity, graphs of generated residuals for each firm from both the individual and (all parameter) master models are presented in Figure 4-1. In a situation of perfect homogeneity, the two graphs would coincide for each firm.

An analysis parallel to the above was next performed for the deferred sub-group for the inclusive period 1964-1973.[6] The minimum standard error regression models are enumerated in Table 4-4, as are the corresponding corrected R^2 statistics, regression standard errors, and Durbin-Watson statistics. As in the flow-through analysis, the F-statistic comparing sums of

---

[6]For General Motors, the minimum standard error regression was rerun to include time as a specified variable. The resulting equation is:

$$y = 15155 - 3.0751 K_1 + 418.21 \text{ [case no]}$$
$$\text{Corrected } R^2 = .253 \qquad SE = 213.56$$

Both the corrected R^2 and SE measures were weaker than in the model exclusive of the time factor. Since it is known that "book" and "tax" depreciation are similar for GM, measurement errors resulting from the use of the "book" surrogate would be minimal therein. If the use of such a surrogate affected the relative performance of the model, across firms, the fit for GM should have been among the best. Contrarily, the fit was one of the weakest. This result seems to support the conclusion that the "book" surrogate did not materially affect the results.

TABLE 4-3A TEST FOR HOMOGENEITY: FLOW-THROUGH FIRMS

Test Statistic:

$$F[\delta_1, \delta_2] = \frac{\frac{\Sigma SS_{m_i} - \Sigma SSI_i}{mn-K_a - \Sigma(n-K_i)}}{\frac{\Sigma SSI_i}{\Sigma(n-K_i)}}$$

where:

δ_1 = degrees of freedom applicable to the numerator

$$= [\, mn-K_a - \sum_{i=1}^{8} (n-K_i)]$$

δ_2 = degrees of freedom applicable to the denominator = $\sum_{i=1}^{8} (n-K_i)$

m = number of firms = 8

n = number of observations per firm = 10

K_a = number of parameters in master model = 8

K_i = number of parameters in model for i^{th} firm

SS_{m_i} = sum of squared errors from application of the master regression model to the ith firm

SSI_i = sum of squared errors from the individual model for the ith firm

(A) All Parameters:

* $\sum_{i=1}^{8} SS_{m_i} = 92,106.97$

* $\sum_{i=1}^{8} SSI_i = 5,122.76$

$\delta_1 = 38$ $\delta_2 = 34$

$$F(38,34) = \frac{\frac{86,984.21}{38}}{\frac{5,122.76}{34}} = 15.19$$

This value is significant at less than the .001 level of significance.

$F_{C.05} \simeq 1.79$

(B) All Parameters Except Constant:

$$*\sum_{i=1}^{8} SS_{m_i} = 1,493,291.22$$

$$*\sum_{i=1}^{8} SSI_i = 5,122.76$$

$\delta_1 = 38 \qquad \delta_2 = 34$

$$F_{(38,34)} = \frac{\frac{1,488,168.46}{38}}{\frac{5,122.76}{34}} = 259.92$$

This value is significant at less than the .001 level of significance.

$F_{C.05} \simeq 1.79$

(C) All Parameters Except Constant and Capital Stock Coefficient:

$$*\sum_{i=1}^{8} SS_{m_i} = 1,369,477.18$$

$$*\sum_{i=1}^{8} SSI_i = 5,122.76$$

$\delta_1 = 38 \qquad \delta_2 = 34$

$$F_{(38,34)} = \frac{\frac{1,364,354.42}{38}}{\frac{5,122.76}{34}} = 238.30$$

This value is significant at less than the .001 level of significance

*See Supporting Schedule in Table 4-3B.

TABLE 4-3B

FLOW-THROUGH FIRMS
DETAILED SUMS OF SQUARED ERRORS

Firm	SS_I	SS_m All Parameters	SS_m All Except Constant	SS_m All Except Constant & Cap. Stock
BABCOCK-WILCOX	109.90	2,564.92	2,463.70	6,410.26
DOW	681.85	17,157.67	220,581.49	366,993.59
INTERNATIONAL HARVESTER	2,218.00	5,659.34	936,416.43	2,676.46
KRAFTCO	136.24	6,794.10	228,265.43	456.73
NORTHROP	235.95	587.50	1,540.28	469.40
SAFEWAY	40.13	31,935.77	19,203.80	805,904.93
TRW	288.39	1,089.82	1,519.25	12,239.80
WESTINGHOUSE	1,412.30	26,317.80	83,300.84	174,326.01
TOTAL	5,122.76	92,106.97	1,493,291.22	1,369,477.18

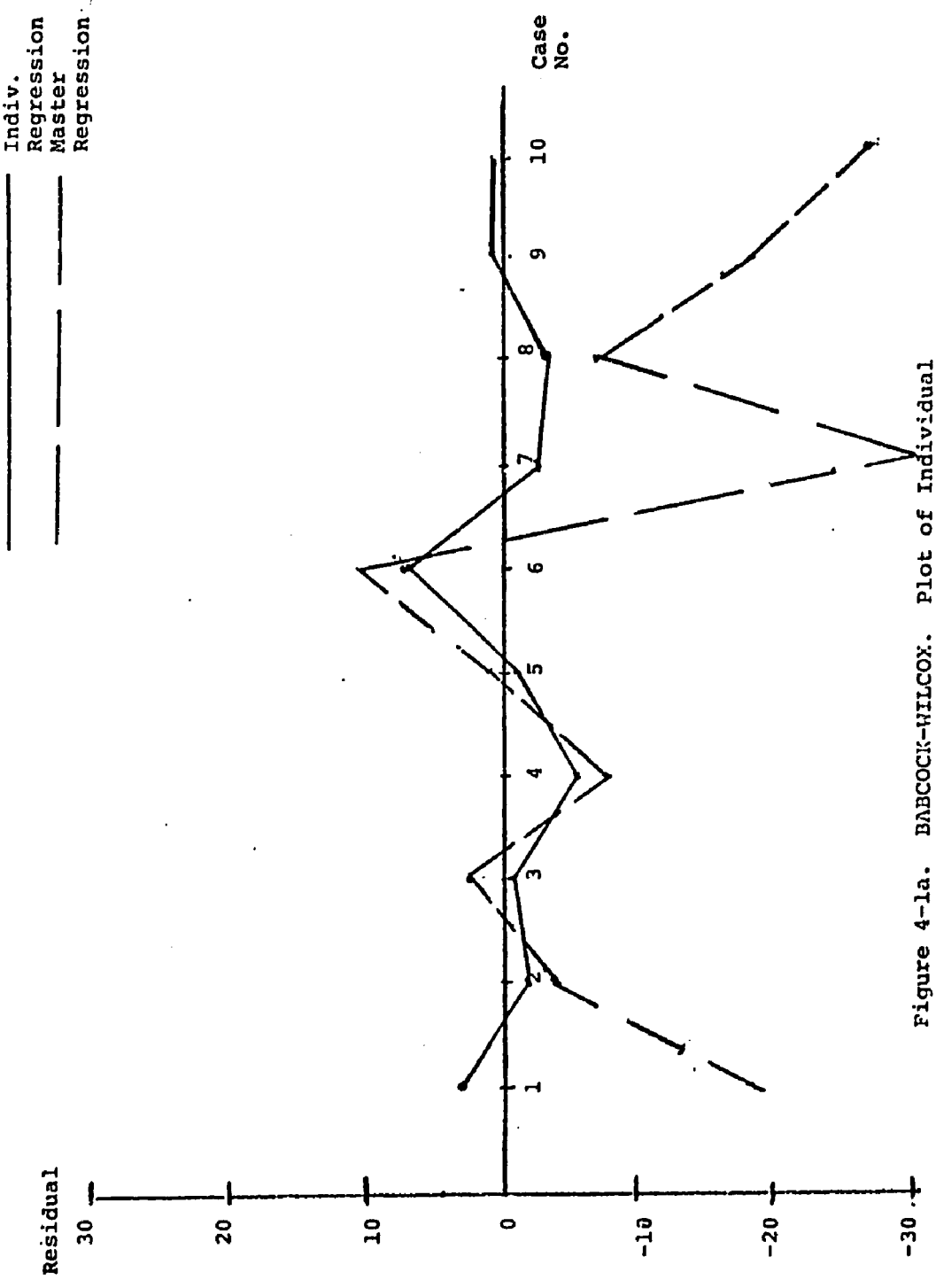


Figure 4-1a. BABCOCK-WILCOX. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

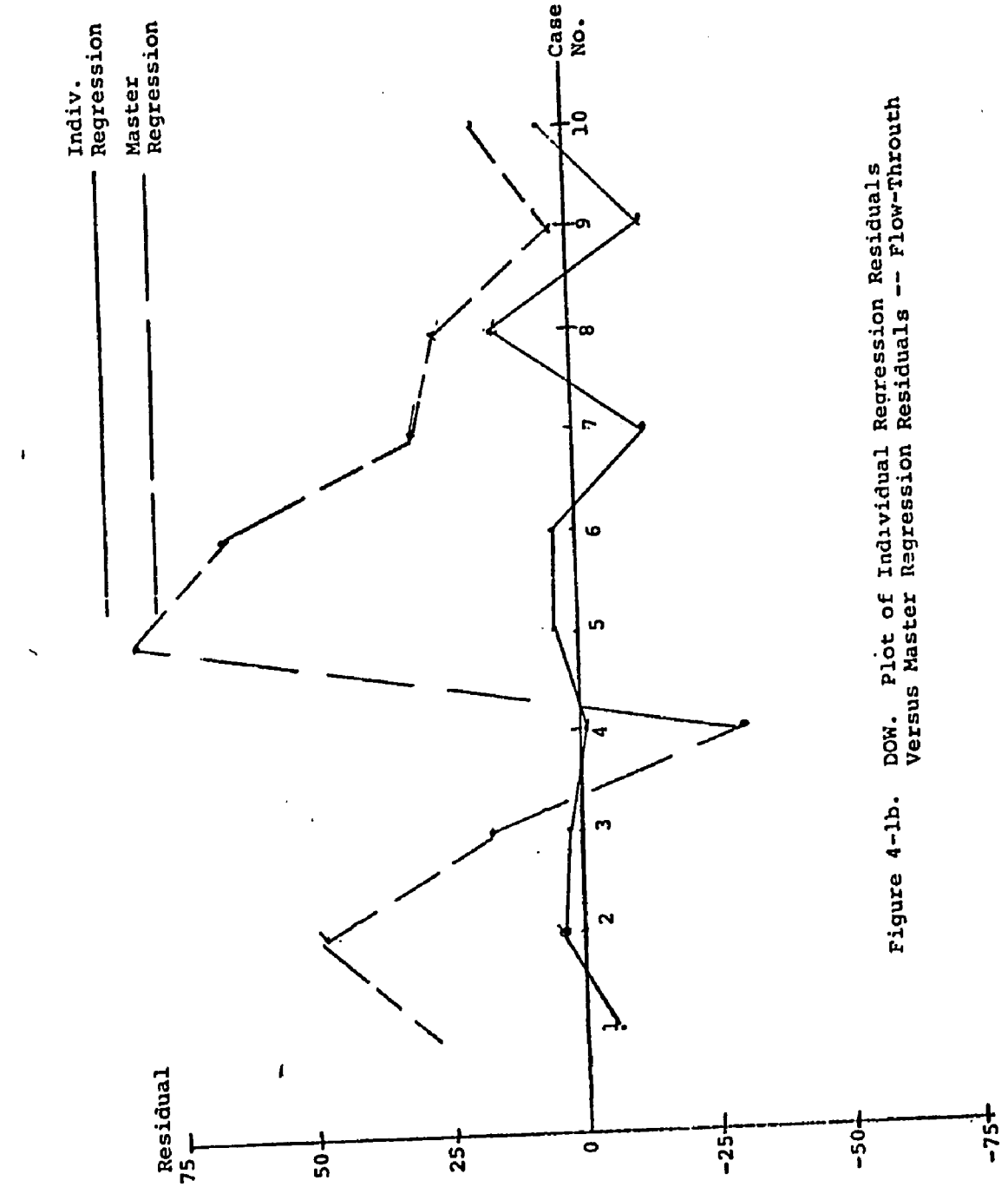


Figure 4-1b. DOW. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Throuth

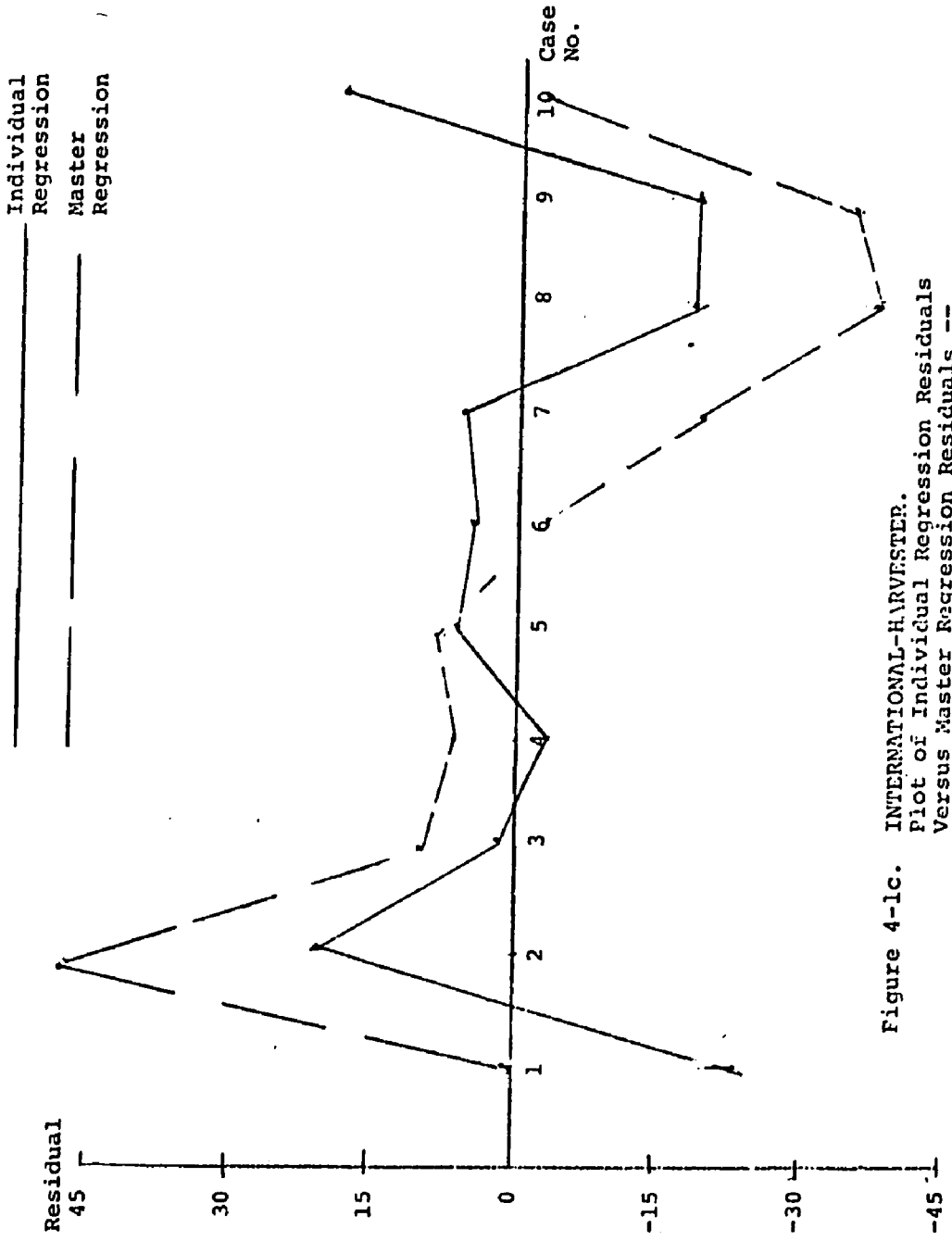


Figure 4-1c. INTERNATIONAL-HARVESTER.
Plot of Individual Regression Residuals
Versus Master Regression Residuals --
Flow-Through

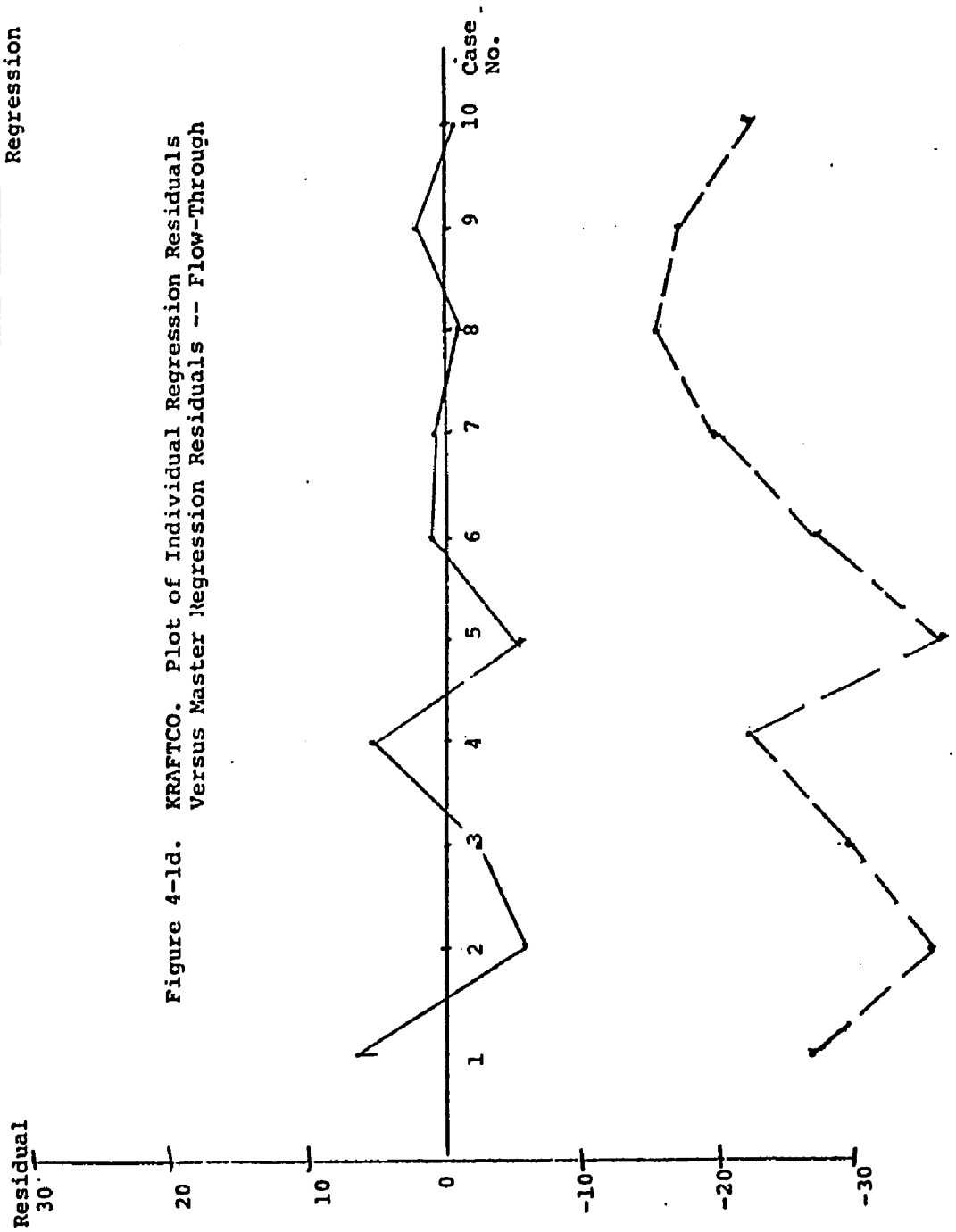


Figure 4-1d. KRAFTCO. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

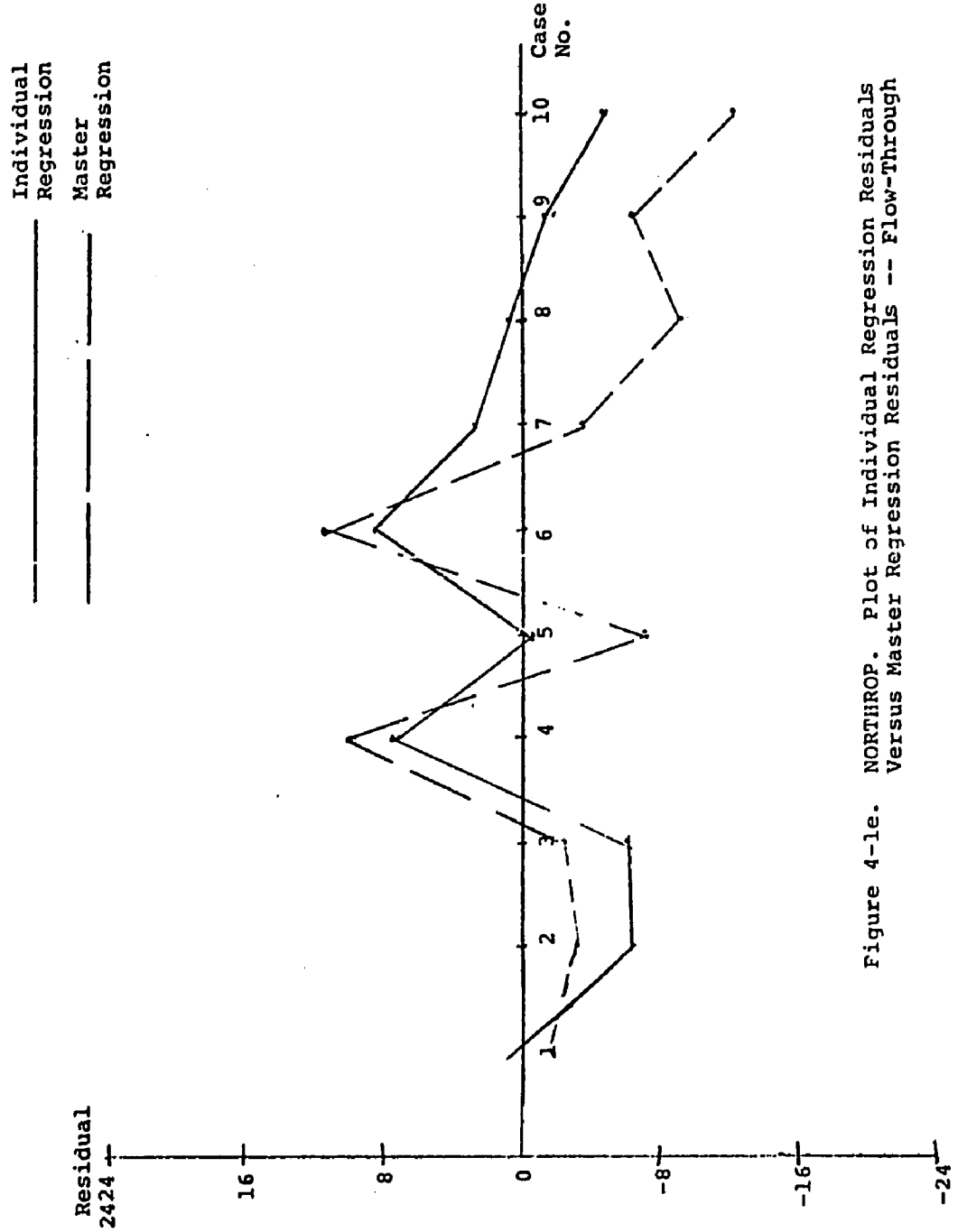


Figure 4-1e. NORTHROP. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

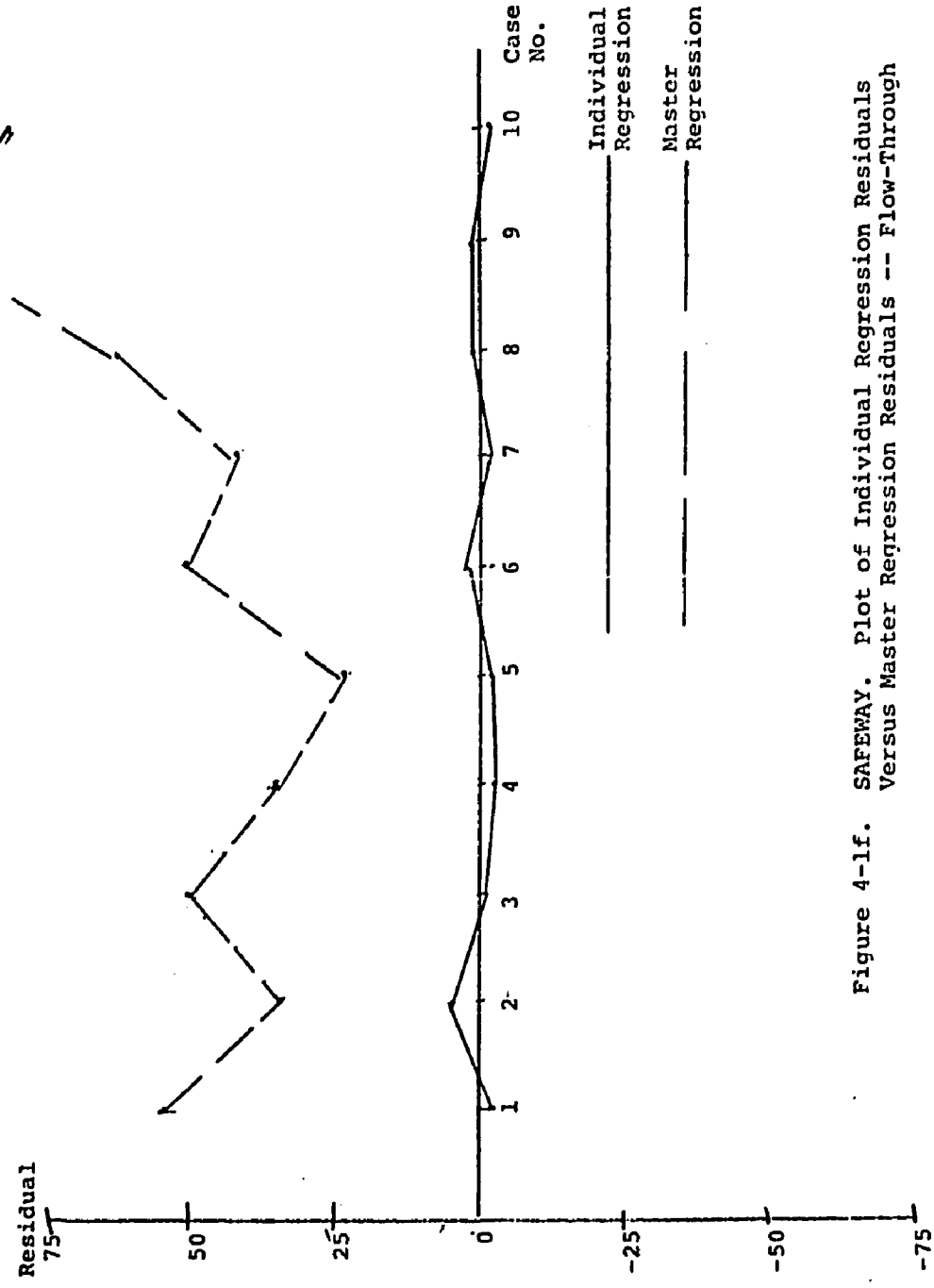


Figure 4-1f. SAFEWAY. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

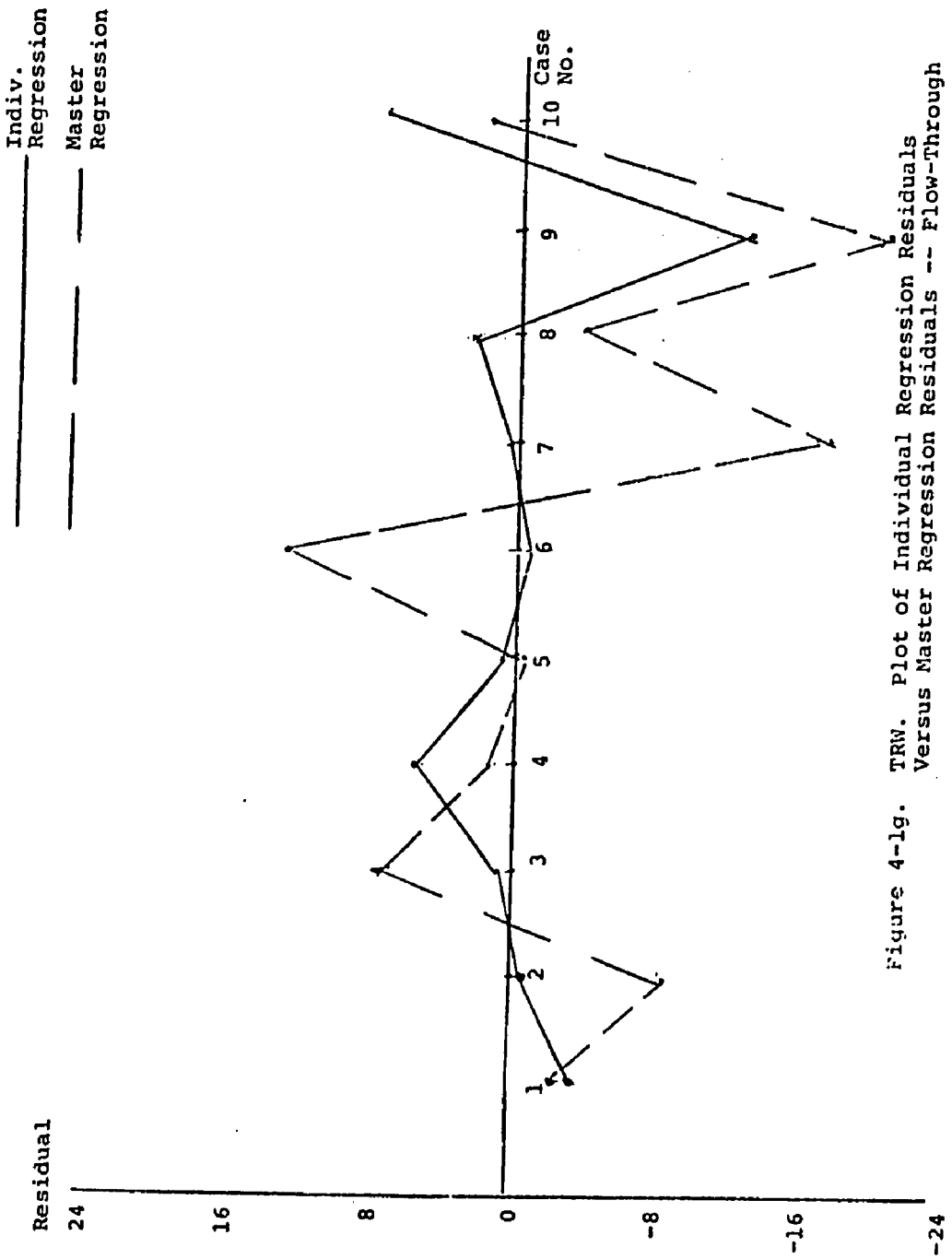


Figure 4-lg. TRW. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

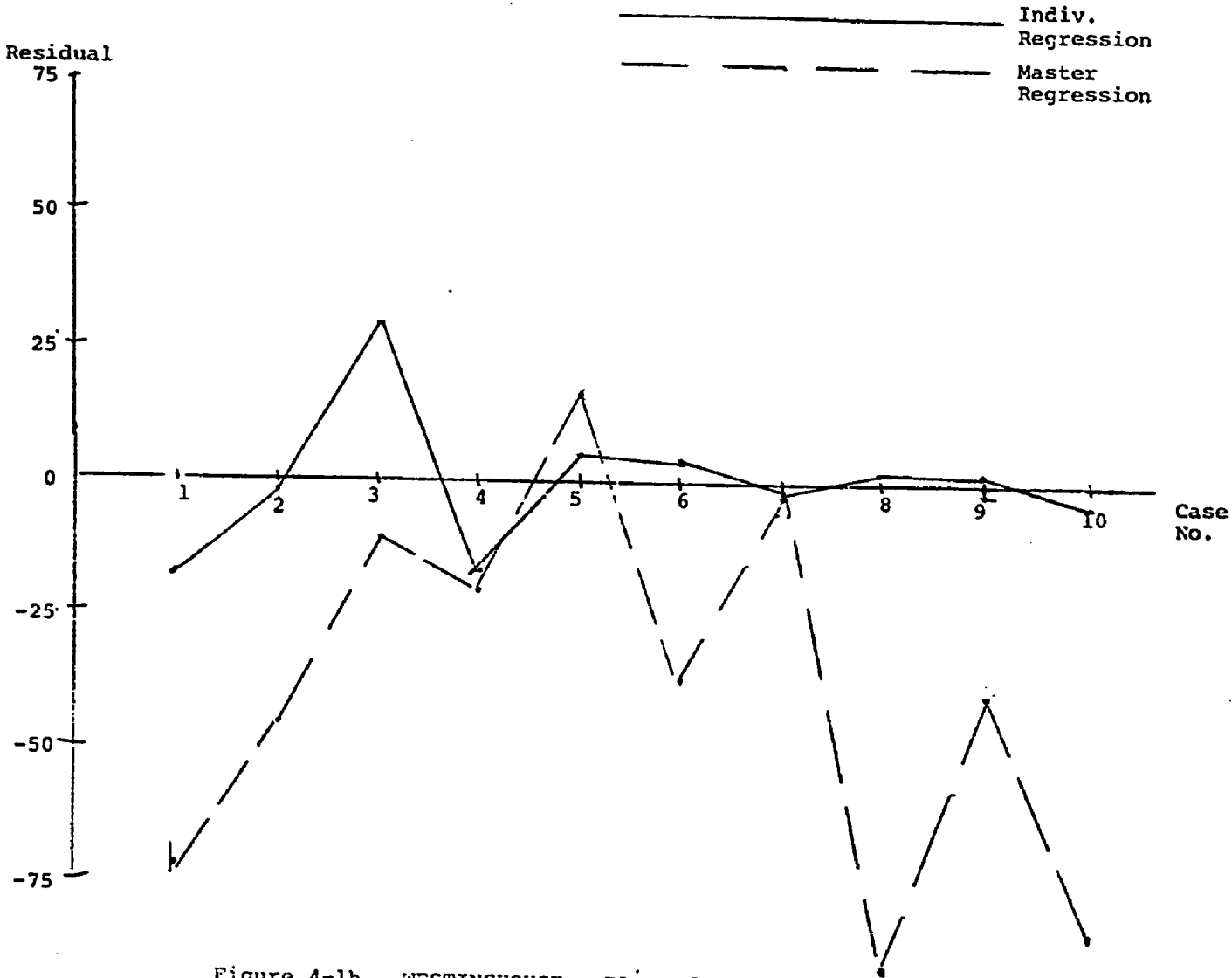


Figure 4-1h. WESTINGHOUSE. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Flow-Through

Table 4-4 Fitted Neoclassical Model Coefficients, Definition of C_t Revised, Deferred Firms 1964-1973

Firm	a	$\frac{P_tQ_t-P_{t-1}Q_{t-1}}{C_t \quad C_{t-1}}$	$\frac{P_{t-1}Q_{t-1}-P_{t-2}Q_{t-2}}{C_{t-1} \quad C_{t-2}}$	$\frac{P_{t-2}Q_{t-2}-P_{t-3}Q_{t-3}}{C_{t-2} \quad C_{t-3}}$	$\frac{P_{t-3}Q_{t-3}-P_{t-4}Q_{t-4}}{C_{t-3} \quad C_{t-4}}$	$I_{t-1}-K_{t-1}$	$I_{t-2}-K_{t-2}$	K_t	Cor. R^2	SE	d
BEATRICE	-11.256	-.0347	.0067	-.0520				.4371	.811	12.010	1.561
BOEING	171.76	-.0280				11.102	-11.289	-.2201	.734	52.731	2.193
COMB. ENG.	-11.058	.0089	.0042	.0082	.0117	.0743	-1.1374	.2767	.739	4.504	2.616
DU PONT	-43.106	.1265	-.0265	.1220	.1778			.2267	.494	66.933	1.793
FORD	461.12	-.0064	.0049	.0132		3.0477	-2.2257	.0802	.556	79.244	3.062
GEN.EL.	-370.29	-.0187	-.0006	-.0255	.0533	5.4498	-5.0481	.4549	.968	22.984	3.366
GEN.MOTORS	3449.70							-.3212	.275	210.39	2.238
GREAT A&P	223.05	-.0022	.0003	-.0015	-.0041	.7748	-1.9127	-.5037	.959	1.809	2.517

squared errors from the master and individual models was utilized. These statistics, along with supportive sums of squared errors, are presented in Tables 4-5A and 4-5B. In all three instances [all parameters, all parameters except constant, and all parameters except constant and net capital stock coefficients] heterogeneity was indicated. Figure 4-2 contains graphs of the residuals from the individual regressions and the (all parameter) master regressions for each firm.

The occurrence of heterogeneity in each sub-group rendered insignificant a test for inter-group homogeneity. In a similar test, Jorgenson and Siebert[7] classified firms into durable and non-durable groups. The "all parameter" test indicated intra-group heterogeneity. However, the master models including individually fitted constants and net capital stock coefficients indicated intra-group homogeneity. One must wonder why the durable/non-durable classification yielded homogeneous results while the flow-through/deferred categorization provided heterogeneous groupings. Several explanations seem possible. First, the differing nature of the classification schemes might fully account for the

---

[7]Jorgenson and Siebert, "Optimal Capital Accumulation," extended version received directly from the authors.

TABLE 4-5A TEST FOR HOMOGENEITY: DEFERRED FIRMS

Test Statistic:

$$F[\delta_1, \delta_2] = \frac{\frac{\Sigma SS_{m_i} - \Sigma SSI_i}{mn-K_a - \Sigma(n-K_i)}}{\frac{\Sigma SSI_i}{\Sigma(n-K_i)}}$$

where:

δ_1 = degrees of freedom applicable to the numerator = $[mn-K_a - \sum_{i=1}^{8}(n-K_i)$

δ_2 = degrees freedom applicable to the denominator = $\sum_{i=1}^{8}(n-K_i)$

m = number of firms = 8

n = number of observations per firm = 10

K_a = number of parameters in master model = 8

K_i = number of parameters in model for i^{th} firm

SS_m = sum of squared errors from the master regression model

SS_{m_i} = sum of squared errors from application of the master regression model to the ith firm

(A) All Parameters

$$* \sum_{i=1}^{8} SS_{m_i} = 1,973,642.51$$

$$* \sum_{i=1}^{8} SSI_i = 406,606.88$$

$\delta_1 = 41, \quad \delta_2 = 31$

$$F_{(41,31)} = \frac{\frac{1,567,035.63}{41}}{\frac{406,606.88}{31}} = 2.91$$

This value is significant between the .005 and .001 levels of significance

$F_{C.05} \simeq 1.79$

(B) All Parameters Except Constant

$$*\sum_{i=1}^{8} SS_{m_i} = 118,175,408.96$$

$$* \sum_{i=1}^{8} SSI_i = 406,606.88$$

$\delta_1 = 41, \quad \delta_2 = 31$

$$F_{(41,31)} = \frac{\frac{117,768,802.08}{41}}{\frac{406,606.88}{31}} = 218.99$$

This value is significant at less than the .001 level of significance

$F_{C.05} \simeq 1.79$

(C) All Parameters Except Constant and Capital Stock Coefficient

$$* \sum_{i=1}^{8} SS_{m_i} = 7,174,663.86$$

$$* \sum_{i=1}^{8} SSI_i = 406,606.88$$

$\delta_1 = 41, \quad \delta_2 = 31$

$$F_{(41,31)} = \frac{\frac{6,768,056.98}{41}}{\frac{406,606.88}{31}} = 12.59$$

This value is significant at less than the .001 level of significance.

*See supporting schedule in Table 4-5B.

TABLE 4-5B

DEFERRED FIRMS
DETAILED SUMS OF SQUARED ERRORS

Firm	SS_I	SS_m All Parameters	SS_m All Except Constant	SS_m All Except Constant & Cap. Stock
BEATRICE	721.16	36,679.69	34,684.84	31,306.76
BOEING	13,903.00	176,458.25	335,774.31	126,702.02
COMBUSTION ENGINEERING	40.57	5,555.26	4,803.14	10,296.02
DUPONT	17,920.00	276,252,96	216,039.38	592,184.67
FORD	18,839.00	266,112.20	3,270,379.78	4,252,057.07
GENERAL ELECTRIC	1,056.60	150,699.74	1,488,438.96	853,665.81
GENERAL MOTORS	354,120.00	1,032,435.45	112,096,495.87	1,281,371.63
GREAT A&P TEA CO.	6.55	29,448.97	728,792.68	27,079.88
TOTAL	406,606.88	1,973,642.51	118,175,408.96	7,174,663.86

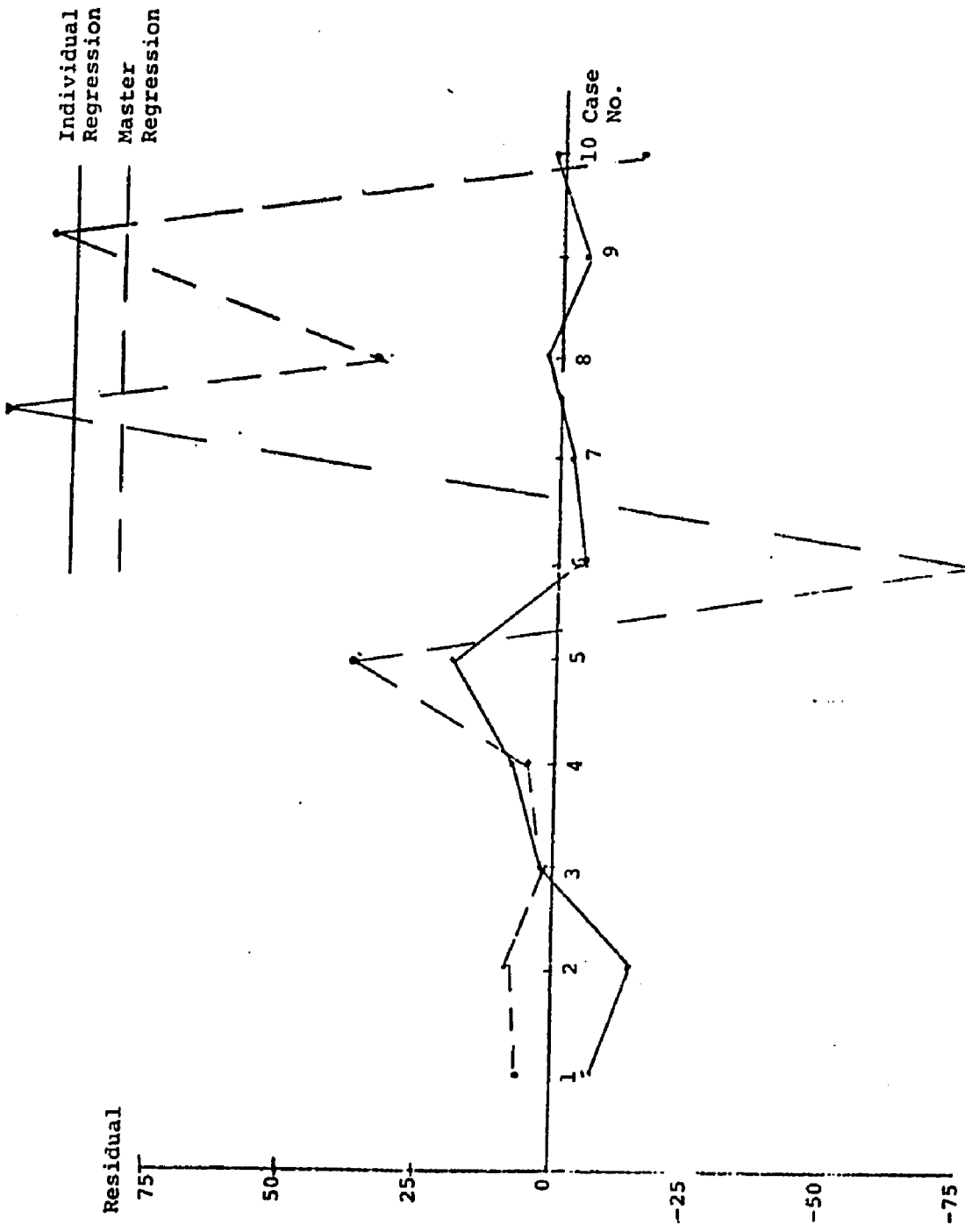


Figure 4-2a. BEATRICE. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Deferred

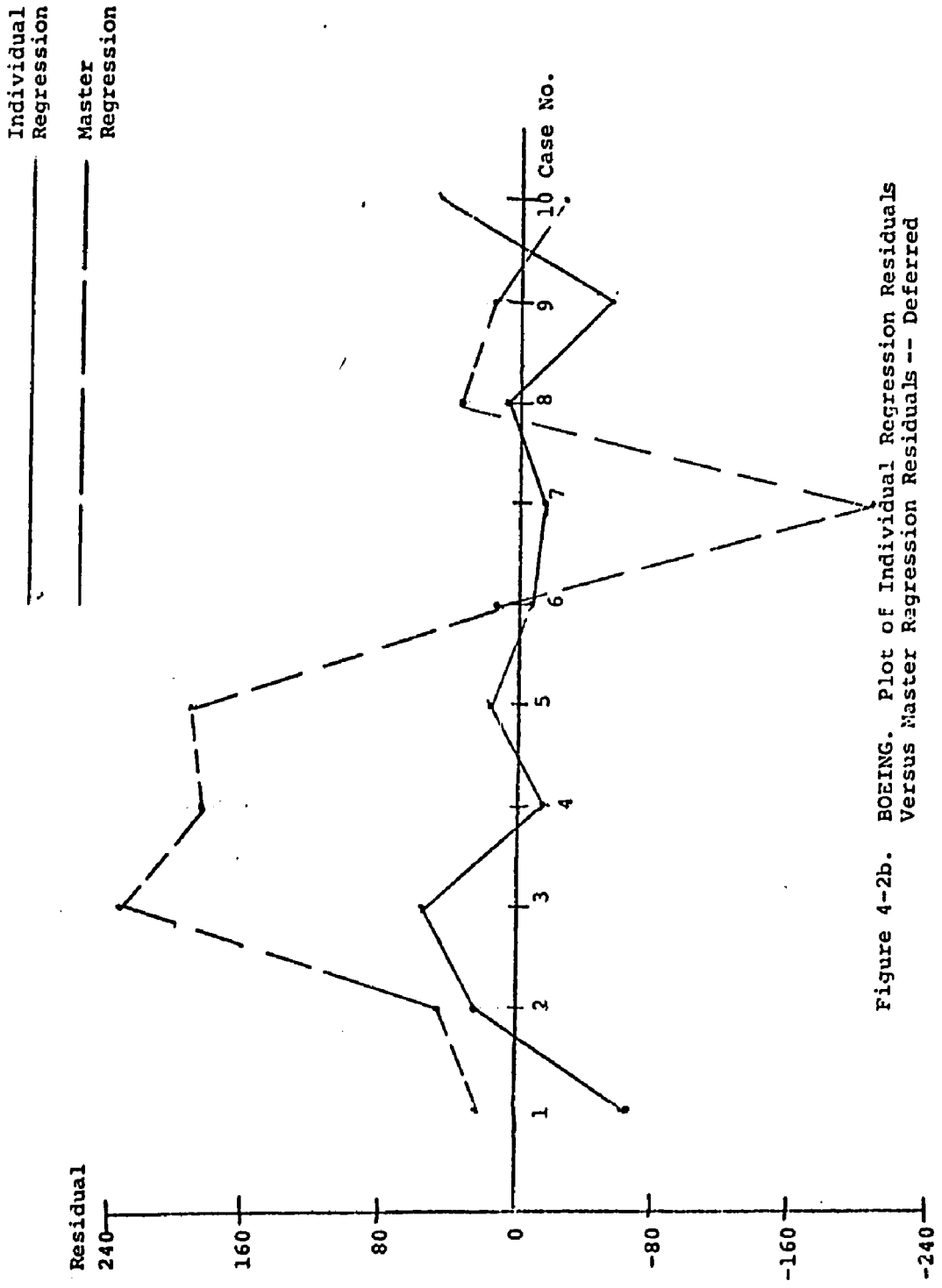


Figure 4-2b. BOEING. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Deferred

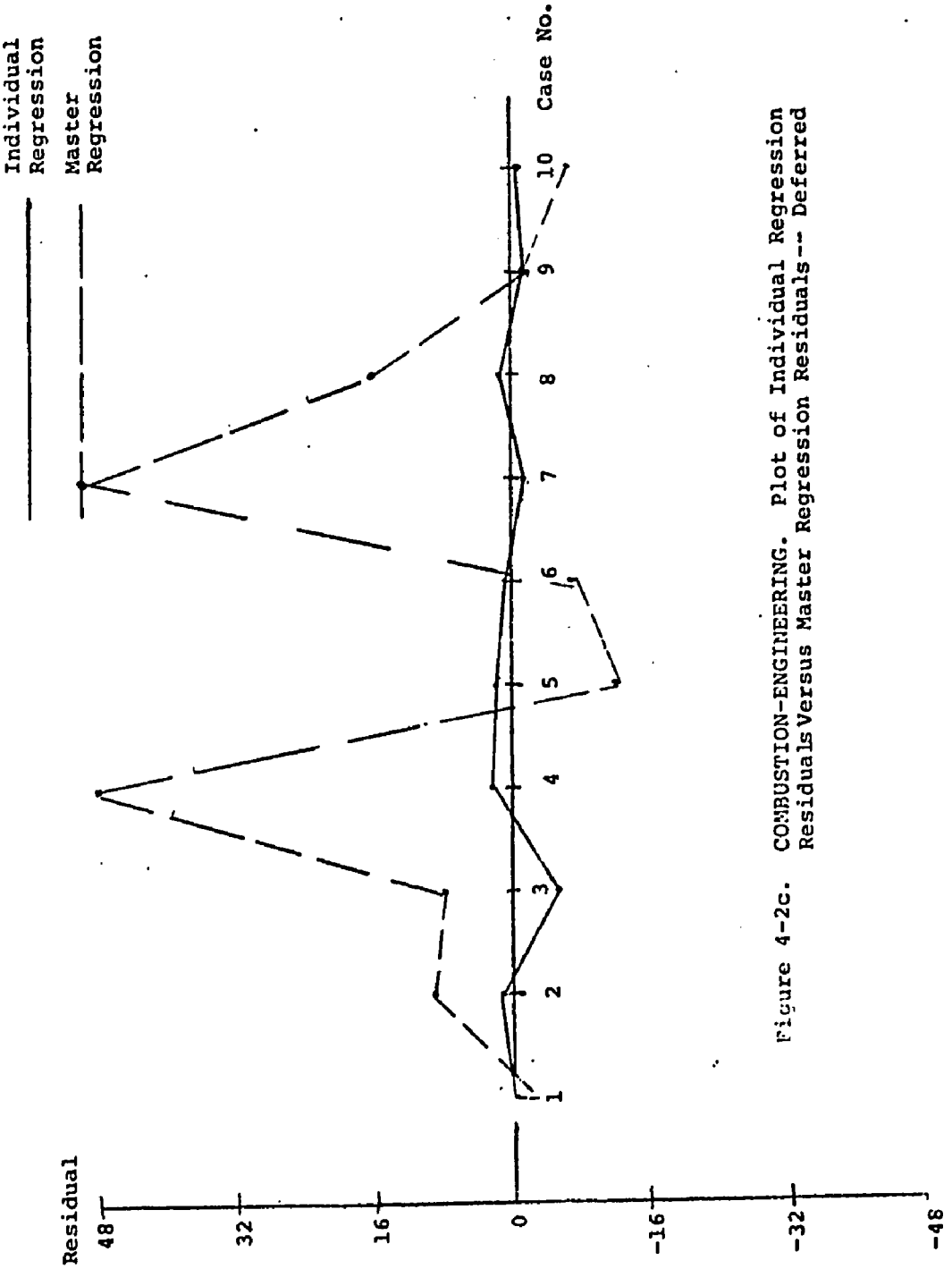


Figure 4-2c. COMBUSTION-ENGINEERING. Plot of Individual Regression Residuals Versus Master Regression Residuals-- Deferred

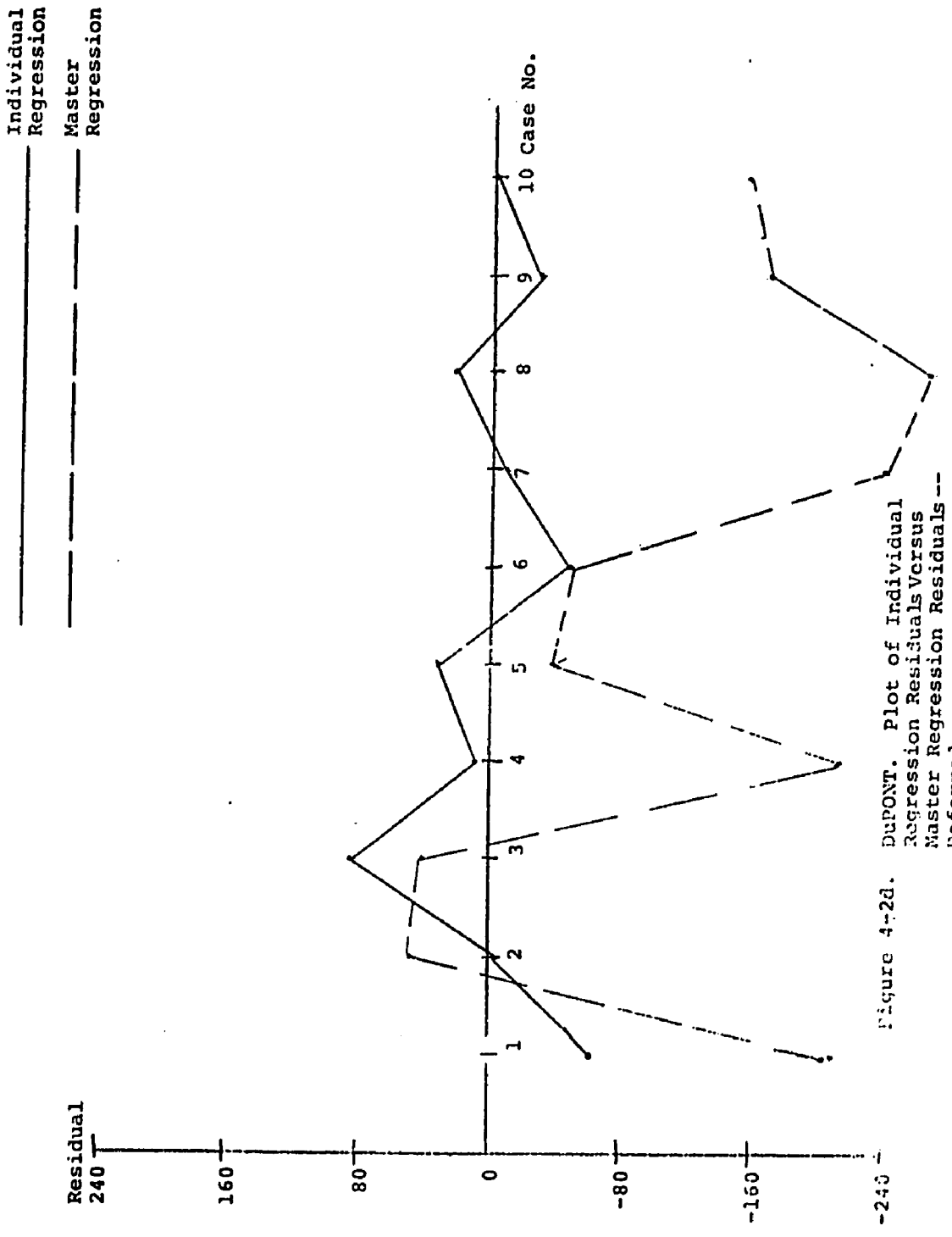


Figure 4-2d. DuPONT. Plot of Individual Regression Residuals Versus Master Regression Residuals -- Deferred

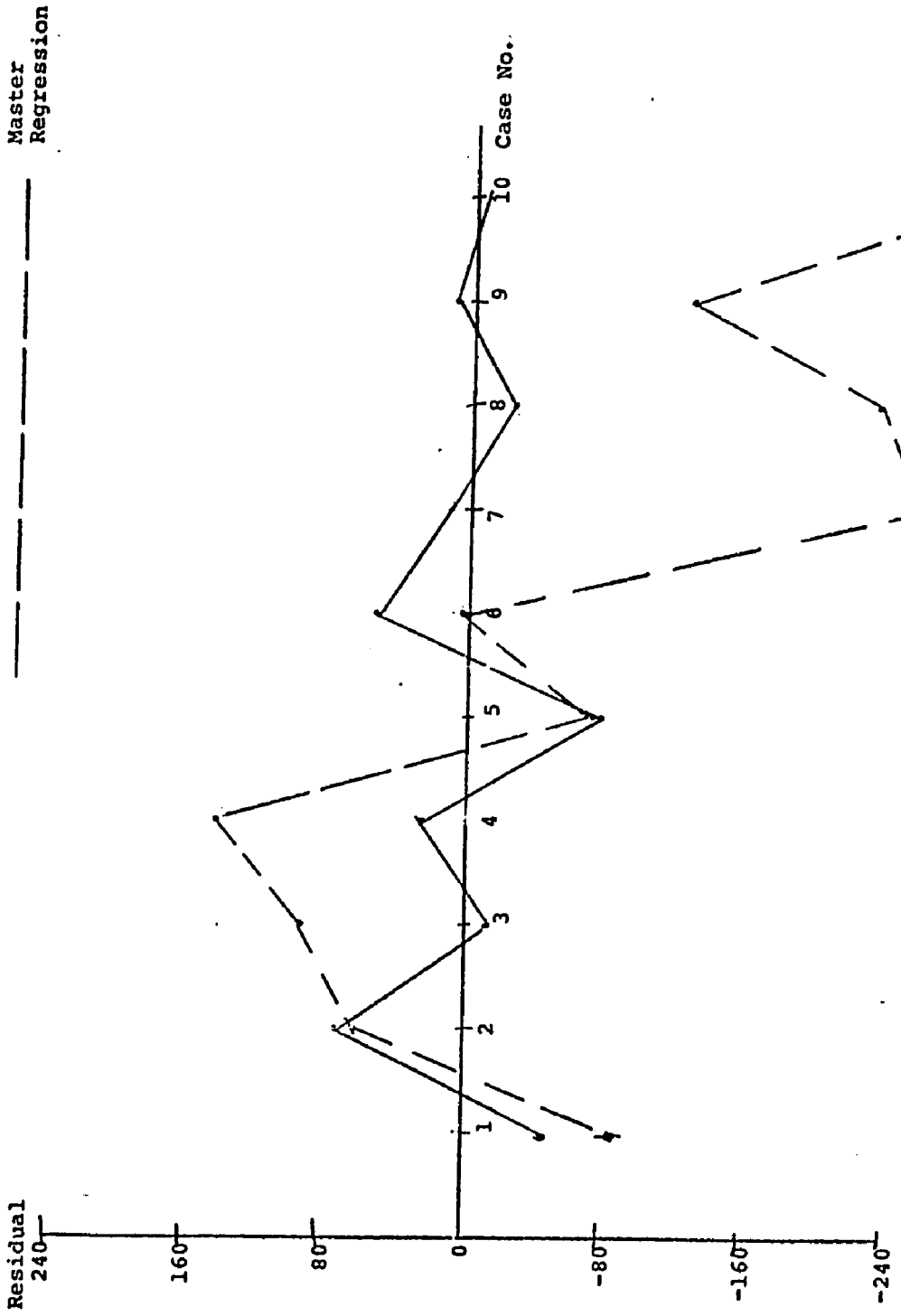


Figure 4-2e. FORD. Plot of Individual Regression Residuals Versus Master Regression Residuals-- Deferred

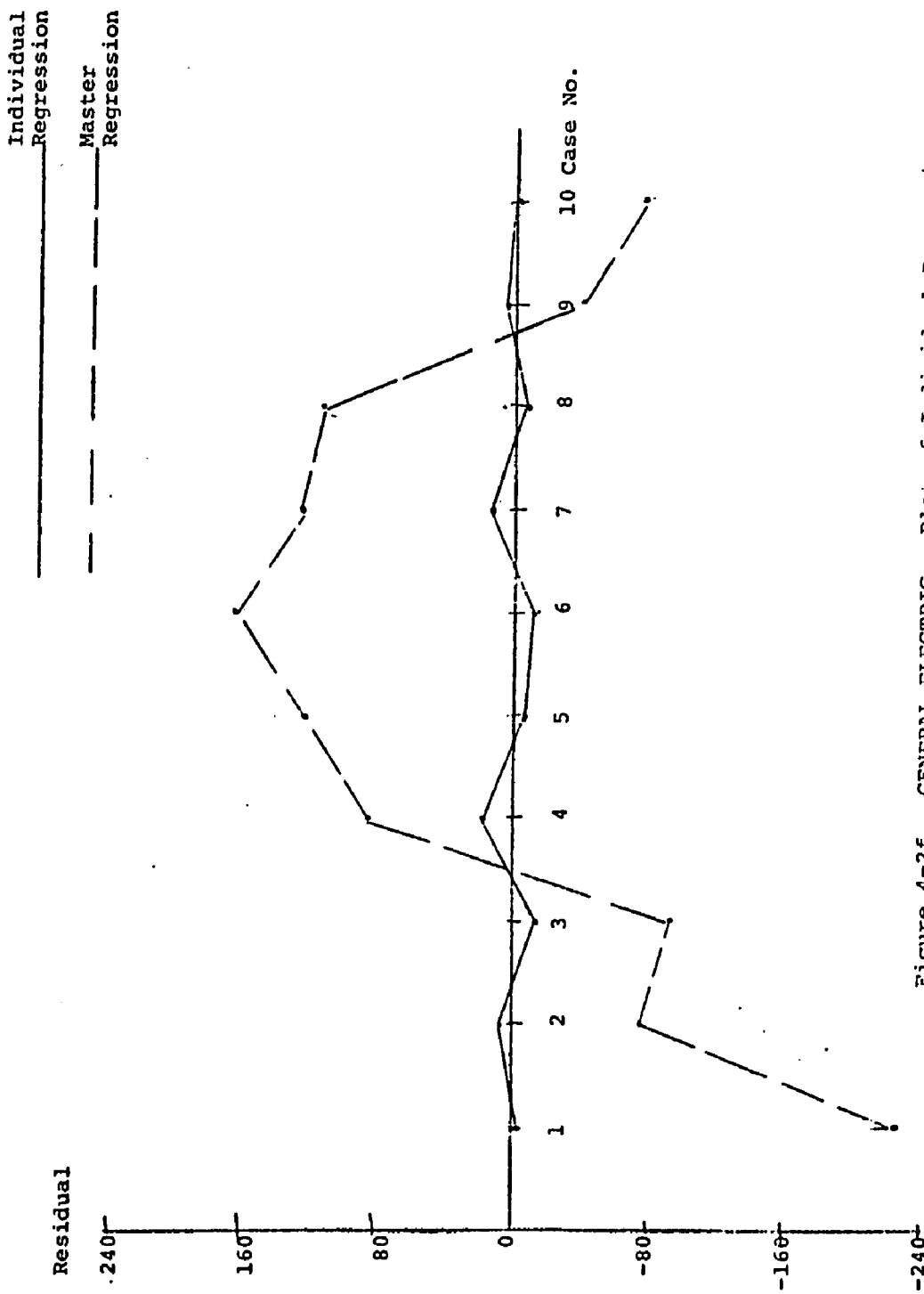


Figure 4-2f. GENERAL ELECTRIC. Plot of Individual Regression Residuals Versus Master Regression Residuals--Deferred

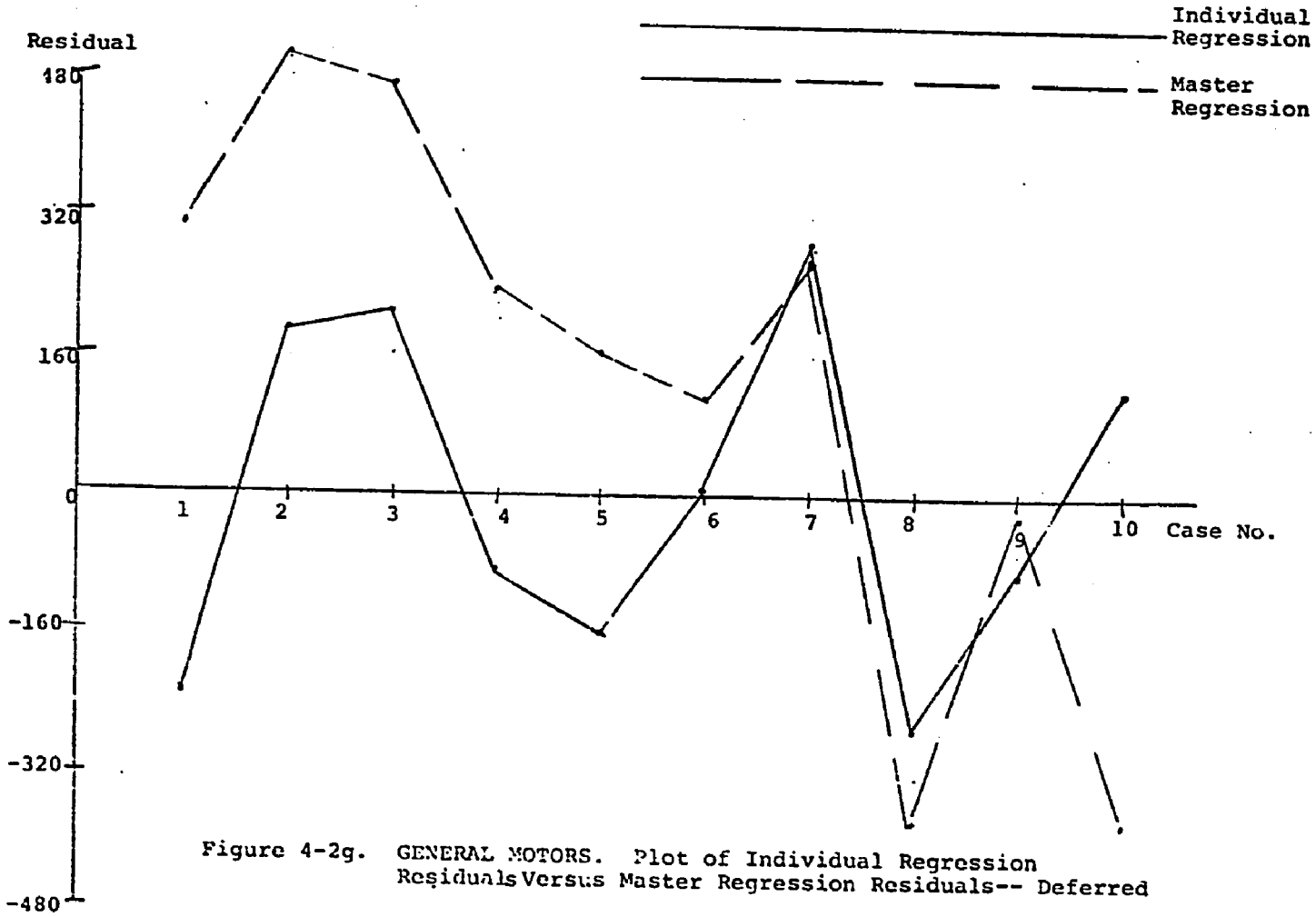


Figure 4-2g. GENERAL MOTORS. Plot of Individual Regression Residuals Versus Master Regression Residuals-- Deferred

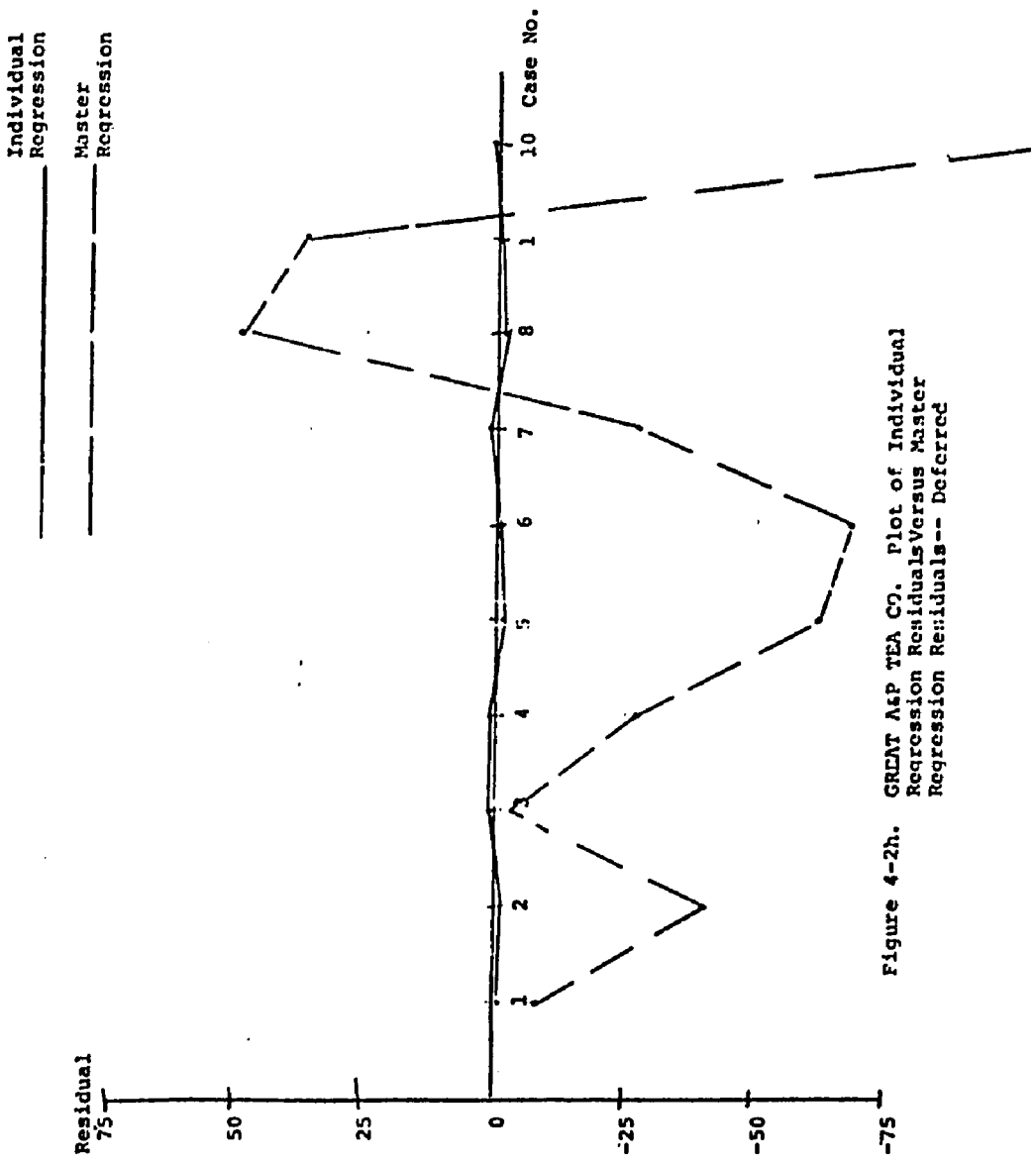


Figure 4-2h. GREAT A&P TEA CO. Plot of Individual Regression Residuals Versus Master Regression Residuals-- Deferred

results. In order to test this possibility, the firms in the current study were reclassified into durable and non-durable components. The homogeneity test was performed for the durable sub-group under the specification that all parameters be the same across firms. The procedure was repeated with individually fitted constants and net capital stock coefficients in the otherwise master model. In both applications heterogeneity was indicated. This result should be considered in light of other questions raised concerning the neoclassical model, as indicated in Note 1 in this chapter on Page 79.

Another explanation for the differences regarding homogeneity attained by the Jorgenson and Siebert and current studies, might be the differing time periods examined. Possibly the time period studied by Jorgenson and Siebert might have been characterized by greater inter-firm uniformity. The scope of this initial application of the neoclassical model to an accounting issue was limited to the tests herein performed. However, the following test for comparability of time periods between the two studies is suggested for future research. The neoclassical model could be applied to the firms utilized herein over the time period studied by Jorgenson and Siebert (1949-1963). These firms could be grouped as

they were in the current study and intra-group homogeneity (heterogeneity) determined.

The current study suggests applications of the neoclassical model which do not specifically address the heterogeneity herein encountered. For example, future studies could specify a dummy variable, for the existence (or non-existence) of the ITC, to be applied to each variable in the neoclassical model. The relative impacts (if any) of the ITC could be examined through analysis of parameter behavior within and between subgroups. The reader is reminded that specification of a separate dummy variable, in the neoclassical model, for the existence (or non-existence) of the ITC was previously ruled out due to the resultant collinearity. The application suggested above would allow the existent coefficients in the neoclassical model to assume differing values during the periods when the ITC was (was not) available. Since the specification of the model variables would remain unchanged, collinearity would not be introduced.

The above discussion suggests only some of the possible adjustments which might render the neoclassical model more effective in isolating the accounting effects of the ITC.

The absence of the condition of intra-group homogeneity in the present case dictated the use of a

supplemental test of the hypothesis that investment behavior between sub-groups was not affected by accounting for the ITC. Such a supplemental test was suggested previously. A brief review is presented in the succeeding paragraphs. For a more complete discussion, see Chapter 2, pp. 44-52.

It should be recalled from Equation (5) in Chapter 2, that desired capital could be re-defined as a function of output in constant dollars. Such re-definition was implemented in the current test. The constraints imposed on potential lagged terms corresponded to those adopted in the neoclassical application: current and up to three lagged changes in desired capital, and up to two lagged net investment terms, considering successive powers of the lag operator beginning with the zero power for desired capital terms and the first power for net investment terms.

Further, a dummy variable, TC, representing the existence (or non-existence) of the ITC was stipulated for each firm. TC assumed the value zero when the tax law provided that the ITC was non-existent and 1 when the ITC was available. The resultant model appeared as follows:

$$I_t = a + \alpha Y_0[Q_t - Q_{t-1}] + \alpha Y_1[Q_{t-1} - Q_{t-2}] + \ldots$$

$$- W_1[I_{t-1} - \delta K_{t-1}] - W_2[I_{t-2} - \delta K_{t-2}]$$

$$+ \delta K_t + TC + \varepsilon_t \qquad (27)$$

where:

a = regression intercept (constant)

αY_i = lag function coefficient applicable to changes in desired capital

W_i = lag function coefficient applicable to net investment

δ = coefficient representing replacement rate

I_t = gross investment in constant dollars

Q_t = output in constant dollars

$I_t - \delta K_t$ = net investment in constant dollars

K_t = beginning net capital stock in constant dollars

ε_t = error term

This model was applied to the data for the period 1963-1973 inclusive.[8] Initially, the regression models were applied EXCLUDING TC. Subsequent applications included TC within the model. The minimum standard error regression equations, excluding and including TC, are presented in Tables 4-6A (flow-through) and 4-6B (deferred). The analyses suggested in Chapter 2 were then performed. A synopsis of such procedures is presented below.

First, the firms in each subgroup were examined regarding the number of equations in which the inclusion of TC lowered the regression standard error. It was determined, as per Tables 4-6A and 4-6B that such inclusion lowered the standard errors for six of the flow-through firms and four deferred firms.

More quantitatively satisfying tests examined the coefficients of TC, scaled by their standard errors, on a comparative basis between sub-groups. The coefficient of a dummy variable impacts upon the constant value. Since the constant term, in econometrics, captures the mean effects of omitted independent variables, the

---

[8]The year 1963 was specifically included in this test. Unlike the preceding test, the results are not as contingent upon the values of each parameter and the loss of the sample case did not seem justified.

TABLE 4-6a

OUTPUT MODEL COEFFICIENTS[A] FLOW-THROUGH FIRMS, 1963-1973

Firm	a	$Q_t - Q_{t-1}$	$Q_{t-1} - Q_{t-2}$	$Q_{t-2} - Q_{t-3}$	$Q_{t-3} - Q_{t-4}$	$I_{t-1} - K_{t-1}$	$I_{t-2} - K_{t-2}$	Kt	ITC	Corrected R^2	SE	ITC* Enter	Scaled Coef. for ITC
BABCOCK- WILCOX	36.924	.0146	-.1831	-.0200	.5387	.2382	-1.4887	-.0229	na	.940	2.355		
	42.174	-.0069	-.1892	.0186	.5219	.0543	-1.5421	-.0243	-2.3009	.915	2.788	0	-.375
DOW	42.609	.1800				1.9296	-1.6964	.1449	na	.738	41.284		
	150.22	.1453	-.1097	-.1610				.1593	-90.606	.820	34.180	+	-3.186
INTERN'L HARVESTER	183.81					2.5195		-.2170	na	.136	17.812		
	228.01	.0071	.0692	.1713	.0929			-.2419	-41.992	.672	10.972	+	-3.275
KRAFTCO	-102.45	.0307	-.0366	-.0975		5.8235	-4.2191	.3250	na	.720	6.589		
	27.345	.0819	.0661			7.4502		-.0499	-14.965	.756	6.163	+	-2.308
NORTHROP	14.122							.0058	na	—0—	5.307		
	21.772							-.0252	-6.8642	.121	4.7343	+	-1.819
SAFEWAY	77.355	.1089	.0697	.0092	.1069	5.2862		-.2595	na	.887	9.867		
	102.61	.1054	.0796	.0326	.1186	5.2765		-.3238	-4.1813	.850	11.338	0	-.172
TRW	-13.276	.0542	.0184	.0265	.0900			.1936	na	.934	5.286		
	-29.310	.0590	.0085	.0522	.1375	-.5563		.2534	11.688	.950	4.591	+	1.685
WESTINGHOUSE	41.022					1.6505		-.0055	na	.696	29.186		
	364.98	.3508	.3752	.5557	.4426	5.4793		-1.0323	100.87	.820	22.500	+	2.708

[A] Top line excludes dummy variable, TC; bottom line includes dummy variable TC.

*+ = yes; 0 = no

TABLE 4-6B OUTPUT MODEL COEFFICIENTS[a] DEFERRED FIRMS, 1963-1973

Firm	a	$Q_t - Q_{t-1}$	$Q_{t-1} - Q_{t-2}$	$Q_{t-2} - Q_{t-3}$	$Q_{t-3} - Q_{t-4}$	$I_{t-1} - I_{t-1}$	$I_{t-2} - K_{t-2}$	K_t	ITC	Corrected R^2	SE	ITC* Enter	Scaled Coef. for ITC
BEATRICE	-3.8469							.2491	na	.773	13.513		
	3.5636							.2452	-8.1118	.761	13.862	0	-.743
BOEING	85.737	.1194				1.7799		-.1432	na	.517	68.743		
	118.85	.1301				1.6696		-.1729	-29.039	.453	73.111	0	-.434
COMBUSTION ENGINEERING	1.0999	.0191	.0595					.1529	na	.711	5.700		
	-3.4584	.0280	.0485					.1609	4.1716	.693	5.880	0	.760
DUPONT	214.64	.2413	.2993			1.3937	-1.9582	.0883	na	.284	75.621		
	44.775	-.0276	.5251					.1141	110.27	.480	64.512	+	1.917
FORD	205.87	.0193	.0621			4.5503	-2.3567	.0575	na	.860	59.018		
	189.35	.0171	.0646			4.4265	-2.2555	.0600	16.464	.827	65.546	0	.231
GEN. EL.	140.22	.1176				3.4976		-.0795	na	.709	83.137		
	76.454	.1787	.0163	.1451		3.8017	-2.6358	.1579	-199.08	.907	47.282	+	-3.433
GEN. MOTORS	475.60	-.0463	.1243	.1784	.1657			.1979	na	.458	201.88		
	834.10	-.0011	.1529	.2007	.2013			.1536	-315.54	.555	183.12	+	-1.441
GREAT A&P	131.64	.0079	-.0045	.0271	-.0350			-.2431	na	.476	6.264		
	155.31	.0221	-.0024	.0361	-.0723	1.3682		-.3228	-14.000	.917	2.505	+	-5.119

[a] Top line excludes dummy variable, TC; bottom line includes dummy variable TC. *+=yes,0 = no

adjustment to the constant term resultant from introduction of the dummy variable (for the influence of the ITC in this case) can be interpreted as the mean impact of the previously omitted dummy variable on the dependent variable, investment.

A review of Tables 4-6A and 4-6B indicates the negativity of several TC coefficients. This negativity is contrary to the theory of the effects of the ITC on investment behavior. A potential explanation of these sign aberrations is that specification and/or measurement errors were present in the application of the models. As discussed in Chapter 2, measurement difficulties were encountered in compilation of input variables. However, for purposes of the succeeding tests, the assumption is implicit that the models were correctly specified and that the data was collected without error.

Throughout this study the various tests have attempted to compare magnitudes of the effects (if any) of the ITC between accounting sub-groups rather than direction of such effects. Consistently, for each of the tests performed on the scaled coefficients, the absolute values of these coefficients were utilized.

The initial test of the significance of the ITC dummy variable was based upon the assumption that the sampling design created matched pairs of firms, with only accounting method as a differentiating factor. This test,

the randomization test for matched pairs, compared the relative sizes of the scaled coefficients between the firms in the two sub-groups. The null hypothesis was that the sizes did not differ significantly between sub-groups. As demonstrated in Table 4-7, this hypothesis could not be rejected at the .05 level of significance.

Critical to the performance of the above test was the assumption that the pairs were indeed matched in respect to all factors except accounting for the ITC. In the event that extraneous variables differentiated the sample firms, the randomization test should be adapted for application to independent samples. The randomization test was applied under the assumption of independent samples. Implicit in the performance of this test was the assumption that the non-random sampling technique of this study did not significantly bias the results. The null hypothesis, again, posited that the sizes of the scaled coefficients did not differ significantly between accounting sub-groups. Due to the large number of potential outcomes (> 12,000), the t-statistic approximation technique (discussed in Chapter 2, p. 51) was utilized. The results presented in Table 4-8 support the conclusion that this hypothesis cannot be rejected at the .05 level of significance.

Both of the above non-parametric statistical tests support the acceptance of the hypothesis that the ITC

TABLE 4-7 RANDOMIZATION TEST: MATCHED PAIRS

PAIR (Def/F-T)	Scaled Coefficient Deferred	Scaled Coefficient Flow-Through	Deferred-Flow-Through
(1) Boeing/Northrop	.434	1.819	-1.385
(2) Gen. Motors/ Int. Harv.	1.441	3.275	-1.834
(3) Ford/TRW	.231	1.685	-1.454
(4) DuPont/Dow	1.917	3.186	-1.269
(5) Gen.El./Westing.	3.433	2.708	.725
(6) Comb.Eng./ Babcock-Wilcox	.760	.375	.385
(7) A&P/Safeway	5.119	.172	4.947
(8) Beatrice/Kraftco	.743	2.308	-1.565
			Σ = -1.450

H_o: Sizes of deferred coefficients (scaled)
= sizes of flow-through coefficients (scaled)

Possible Outcomes = 2^8 = 256

α = .05

Rejection Region Outcomes = .05(256) = 12

2-tailed test

Minimum upper tail rejection region sum = 10.794

Minimum lower tail rejection region sum = -10.794

Conclusion: Cannot reject H_o at .05 level of significance

TABLE 4-8

RANDOMIZATION TEST: INDEPENDENT SAMPLES

FIRM (Deferred/Flow-Through)	Def. Scaled Coeff. D	$\left(\text{Def. Scaled Coeff.} - \bar{D}\right)$	$\left(\text{Def. Scaled Coeff.} - \bar{D}\right)^2$	F-T Scaled Coeff. F	$\left(\text{F-T Scaled Coeff.} - \bar{F}\right)$	$\left(\text{F-T Scaled Coeff.} - \bar{F}\right)^2$
(1) Beatrice/Babcock-Wilcox	.743	-1.017	1.034	.375	-1.566	2.452
(2) Boeing/Dow	.434	-1.326	1.758	3.186	1.245	1.550
(3) Combustion Engineering/ Int. Harv.	.760	-1.000	1.000	3.275	1.334	1.780
(4) DuPont/Kraftco	1.917	.157	.025	2.308	.367	.135
(5) Ford/Northrop	.231	-1.529	2.338	1.819	- .122	.015
(6) Gen.El./Safeway	3.433	1.673	2.799	.172	-1.769	3.129
(7) GenMotors/TRW	1.441	-.319	.102	1.685	- .256	.066
(8) A&P/Westinghouse	5.119	3.359	11.283	2.708	.767	.588
Mean:	$\bar{D} = 1.760$			$\bar{F} = 1.941$		
Σ			20.339			9.715

H_o = Sizes of deferred coefficients (scaled) = sizes of flow-through coefficients (scaled).

test statistic: $$t = \frac{\bar{D} - \bar{F}}{\sqrt{\frac{\Sigma(D-\bar{D})^2 + \Sigma(F-\bar{F})^2}{n_D + n_F - 2} \cdot \left(\frac{1}{n_D} + \frac{1}{n_F}\right)}}$$

$t = -.247$; $df = 14$; $t_{C.05} = 2.145$

Conclusion: Cannot reject H_o at .05 level of significance.

Note: Necessary conditions for application of the above test statistic were that the ratio of $\frac{N_1}{N_2} \geq 1/5$ and ≤ 5. This ratio = 1 in the current test. Further, kurtosis (peakedness) must be small for the combined sample. The computed relative kurtosis measure, $\beta_2 = 2.718$. For the normal curve this measure = 3.0. Therefore, the kurtosis requirement was assumed fulfilled.

---

did NOT manifest a differing level of impact between the accounting sub-groups. These results assume even greater significance in light of the bias toward non-comparability of the scaled coefficients. Again, this bias was introduced through the existence of differing degrees of freedom relevant to the coefficients.[9]

The final chapter attempts to synthesize the material presented heretofore. The results of the study are examined regarding potential significance to the accounting profession and lawmakers. Further, the neo-classical model is reconsidered in light of its performance in the current study.

---

[9] For an elaboration of this point, see Chapter 2, p. 47.

CHAPTER 5

CONCLUSIONS

As stated in Chapter One, the purpose of the current study was to address the question of the effects (if any) of alternative external accounting principles upon the internal decision-making process in the case of a specific issue: accounting for the investment tax credit (ITC). This history of accounting for the ITC was chronicled in Chapter One.[1] One particular event in that history is noteworthy and served as a catalyst to the undertaking of this research project: in 1971 the U.S. Congress Legislated that no taxpayer shall be precluded from using any method of acounting for the ITC for external reporting purposes. The premise upon which such intervention was based was summarily stated by Charls Walker, an Assistant Treasury Secretary:

> It seems self-evident that ... businessmen will have less motivation to purchase new equipment if the benefits of the credit are not reflected in operating results when realized.[2]

The hypothesis of the current study was that the method of accounting for the ITC did NOT affect the equipment

---

[1] See Chapter 1, pp. 2-7.

[2] Letter from Charls Walker to Senator Russell B. Long, Journal of Accountancy, February 1972, p. 72.

investment decision of a sample of firms. The preceding chapters detailed the sample selection, data collection, and statistical testing methods as well as the empirical results. This chapter attempts to synthesize the results and offer conclusions derived therefrom.

To reiterate, an econometric model of corporate investment was fitted for each firm from each sample sub-group: flow-through and deferred. The underlying theory of the model is that a firm establishes a level of desired capital stock (property) and initiates investment projects designed to equate actual property on hand with the level of desired capital. The critical parameters of the model characterize the intertemporal investment pattern of the firm in its quest to acquire the desired level of capital.

In the initial generation of the models, desired capital was treated as a function of output in current dollars, deflated by the cost of capital services (neo-classical definition). The minimum standard error model was identified for each firm in each sub-group. The sub-groups were then tested for homogeneity of model parameters WITHIN each classification. If the parameters were homogeneous, intergroup comparisons would have been relevant. However, each sub-group was found to contain heterogeneous parameters. As a result, intergroup comparisons would not have been statistically meaningful.

Therefore, supplemental tests of the hypothesis, that accounting for the ITC manifested NO effect on the corporate equipment investment decision, were conducted. The econometric models were re-applied with desired capital depicted as a function of output, in constant dollars. A dummy variable for the existence (or non-existence) of the ITC was stipulated for each firm. Several tests were performed upon the results of the models derived from the output definition. Initially, for each sub-group, the number of firms in which the inclusion of the dummy variable lowered the regression standard error was determined. Although no statistical test of differing performances was available, an extreme difference would have provided support for rejection of the study hypothesis. No such result was forthcoming. For six of eight flow-through firms and four of eight deferred firms, the inclusion of the dummy variable lowered the regression standard error.

Next, for the minimum standard error equation including the dummy variable, the coefficient of this variable was scaled by its standard error. Non-parametric randomization tests were then performed to test for differences (if any) in absolute values of these scaled coefficients between sub-groups. The tests were applied first under the assumption of matched pairing of the samples and next under the assumption of independent samples. Under

each assumption, the hypothesis of no difference in the sizes of scaled coefficients between sub-groups could not be rejected.

The results of the above research do not provide definitive support for either rejection or acceptance of the study hypothesis. However, the results do accomplish two important tasks. First, relevance of assertions regarding effects of alternative accounting principles is cast in a new light. Further, paths for future research are suggested. Each element is considered in turn.

The "self-evidence" assumption offered by the Treasury Department in 1971 was clearly not supported by this study. If such an obvious behavior pattern characterized the corporate equipment investor, such pattern should have been manifested in the current study. The tests based upon the output definition of desired capital created doubt that accounting for the ITC affected the corporate equipment investment decision. The other test (neoclassical definition) was inconclusive. If any effects were existent, they were not evident. If the "self-evidence" assumption were valid, the results of this study would seemingly have provided some support.

There are those who would argue that the issue addressed herein, the "self-evidence" assumption, is merely one of semantics. The proponents of that position

need only refer to the debate regarding lease accounting. As stated in Chapter One, a Congressman maintained that:

> It seems OBVIOUS that if leases must be accounted for as indebtedness, additional amounts of equity capital will be required to balance financial ledgers. At the present high cost of capital, this could result in significant and inflationary effects on the prices of a great variety of goods and services...3
> (emphasis added)

Hopefully, the current study will aid in convincing those evaluating the interface between accounting and economic reality that assertions of "self-evident" and "obvious" effects are insignificant unless supported by "hard evidence." If such support is not offered, hopefully, future consideration of such claims will attempt to pry apart the political and economic underpinnings.

As stated above, the impact (if any) of accounting for the ITC was not definitively isolated in the current study. However, directions were suggested which should assist in future attempts at isolation. In the succeeding paragraphs, necessities for such isolation are addressed, followed by specific suggestions related thereto.

The effects (if any) on internal decision-makers resulting from external reporting policies have gone largely unstudied. Instead, "theories" (such as

---

[3] Journal of Accountancy, January 1975, pp. 7-8.

Mr. Walker's) have been offered. In this writer's opinion, this area is ripe for indepth research. The ITC issue did not exist in a vacuum. Innumerable future policy decisions could hinge upon ASSERTED behavior of managers (e.g., accounting for leases, exploration costs and research and development). The ability to compare relevant decision parameters between firms utilizing alternative accounting principles would, seemingly, provide invaluable input to the accounting rule makers. Therefore, immediate future research plans include expansion and refinement of the current study in a further attempt to definitively isolate the effects (if any) of accounting for the ITC. If successful, this attempt will provide the background for examination of related issues (such as accounting for leases and exploration costs). The most pressing hurdle facing such further research is improvement in the evaluative model of corporate investment utilized in the current study.[4]

---

[4]A potential danger in empirical research is acceptance of an oft-written model on the basis of its frequent appearance in print. Recently, the accounting and finance journals have contained sundry articles which utilize the "market model" in an attempt to find whether various accounting numbers have information content in an efficient capital market. Such research is extremely worthwhile. However, a juncture has seemingly been reached where improvements in the testing procedure are appropriate. Valid questions regarding the validity and use of the market model linger. Instead of continually reapplying the basic testing procedure, future researchers should consider addressing the lingering questions in an attempt to provide a stronger tool for continued research.

Dale Jorgenson and Calvin Siebert have provided a valuable start in the evaluation of the neoclassical model of corporate investment. Nevertheless, future tests of this model seem not only appropriate, but essential. In the current study, it was necessary to redefine some of the components of the structural variables in the model. For instance, the originally constructed cost of capital and rate of replacement variables both contained accounting and economic inconsistencies. The accomplishment of such redefinition made possible the performance of a critical portion of the current research. Simultaneously, the current research underscored the need for further improvement in the model, even as redefined. For several companies, the explanatory ability of the desired capital coefficients was zero, resulting in a virtual autoregressive scheme. These results suggest that cogent elements of the model are mis-specified. One area seems most prone to such mis-specification: the cost of capital services, C_t.

The cost of capital services consists of several individual elements. The cost of capital, r_t, component attempts to capture the market-determined interest-rate applicable to the individual firm. However, as defined by Jorgenson and Siebert, r_t approached zero in some instances and on occasion even became negative!

This illogical behavior serves as a warning that future research should reconsider the definition of r_t. Further, the surrogate measure of holding gains, the change in a general price index, seemingly oversimplified the unique capital situations faced by many firms. Finally, an improved designation of C_t, would likely require access to detailed company records. For instance, such relevant factors as acquisition dates for capital assets and tax deductible depreciation are presently unpublished information and estimates are required.

The essence of the above comments suggest extensive data gathering for reapplication of the neoclassical model. Emphasis upon the firms in one or two industries might prove a prerequisite for such an attempt. Further, improvement in the underlying measurements of the model might facilitate application of the statistical tests suggested in the preceding chapter.[5]

Another area ripe for re-examination concerns relative scale of sample firms. The F-ratio utilized in

---

[5]See Chapter 4, pp. 98, 110-111.

the homogeneity test considered the difference in residuals resulting from application of the master and individual regression models to the data of the same firms. The intra-firm nature of this comparison would seemingly reduce potential scaling difficulties. However, the implicit assumption of the same standard errors across firms may prove an oversimplification of reality. For this condition to hold, the residuals would have to assume the same magnitude for each firm. Emphasis upon similar size firms may be essential in other applications of this model in an attempt to fulfill this condition.

Finally, statistical time-series procedures which do not require an assumed distributed lag generating process, but instead allow the data to dictate which generating process is appropriate are presently in the developmental stages. When completed, these procedures should prove invaluable in future attempts to study the behavior of investment parameters.

In conclusion, the major contribution of the current study was NOT the few answers provided, but the important questions suggested. Future research into these questions seems not only justified but also genuinely important.

APPENDIX

The raw data (in millions of dollars, except for indices) for each sample company are presented in the following pages. Additional information to assist the reader in interpreting the data is herein listed:

1. The basic sources for the data are presented in the preceeding chapters. As a reminder, Moody's Industrial Manual [1] was a key source.

2. Investment credit earned is not enumerated since such data was obtained, in some cases, in confidential correspondence.

3. The *pt* indices, used in deflating output, were based on 1967 = 100. For the firms in one industry, aerospace, such a base was not available. A surrogate measure was provided by the Wholesale Price Index applicable to industrial commodities, the parent category.

4. The investment goods price deflator, q_t, was uniform between firms and is presented below.

---

[1] Moody's Industrial Manual, various annual issues

(1967 = 100)

1959	.913
1960	.920
1961	.919
1962	.920
1963	.922
1964	.928
1965	.939
1966	.968
1967	1.00
1968	1.032
1969	1.064
1970	1.114
1971	1.155
1972	1.179
1973	1.217

BABCOCK-WILCOX INPUT DATA (all in current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	13.18	291.06	76.94	127.80	67.87	241.57	7.65	33.65	16.22	.904
1960	6.11	266.75	63.36	140.59		251.15	8.54	36.50	18.12	.912
1961	6.19	268.72	66.19	146.14		259.01	8.67	43.12	20.54	.905
1962	25.66	277.24	72.15	151.52		270.11	10.34	44.11	21.11	.909
1963	23.10	321.39	87.63	176.50		285.11	11.23	46.27	22.03	.914
1964	12.27	370.33	93.45	198.83		302.32	12.82	49.27	25.79	.919
1965	19.61	412.49	93.28	214.95		332.49	13.52	56.34	30.28	.925
1966	34.81	485.63	106.81	232.86		356.79	14.79	62.48	33.77	.966
1967	33.51	545.93	137.52	266.40		392.38	16.44	61.25	33.99	1.000
1968	37.38	584.52	162.15	298.32		438.67	10.93	49.69	25.98	1.033
1969	50.52	690.11	204.92	334.56		516.03	13.44	6.50	6.31	1.070
1970	25.34	782.78	222.82	383.36		592.97	16.42	17.24	10.85	1.137
1971	24.28	895.70	213.91	406.69		645.00	18.40	38.59	21.42	1.191
1972	41.90	890.90	205.98	426.38		658.99	19.40	42.30	24.52	1.224
1973	36.84	999.02	223.71	460.54		716.58	21.64	36.66	22.21	1.270
1974			253.89	494.09	253.12					

DOW INPUT DATA (all in current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-Ation	Profits Before Taxes	Profits After Taxes	P_t
1959	59.29	510.52	159.71	1030.41	563.96	875.01	159.71	116.34	63.09	1.016
1960	101.60	550.89	146.12	1065.84		859.08	146.12	150.66	82.34	1.018
1961	148.00	607.17	156.52	1140.43		901.24	156.52	108.08	64.35	1.007
1962	123.26	1076.74	172.19	1256.50		1039.70	172.19	199.43	110.86	.991
1963	82.14	717.07	165.42	1254.95		1021.49	165.42	145.35	80.75	.979
1964	166.09	790.61	167.70	1244.62		1068.52	167.70	162.38	93.88	.983
1965	248.34	860.23	187.61	1346.66		1271.26	187.61	181.60	108.10	.990
1966	241.48	956.61	183.66	1523.27		1526.76	183.66	201.18	121.68	.994
1967	192.34	1014.56	195.25	1673.49		1704.97	195.25	216.53	130.83	1.000
1968	306.34	1207.23	216.55	1756.02		1910.62	216.55	231.94	139.94	.998
1969	370.58	1333.84	276.33	2060.43		2312.23	276.33	235.38	153.88	.999
1970	362.66	1401.04	289.07	2305.13		2619.78	289.07	224.37	136.27	1.022
1971	364.97	1517.25	368.24	2524.31		2779.80	368.24	250.12	159.12	1.042
1972	366.75	1760.78	395.46	2722.90		3078.81	395.46	324.03	196.93	1.042
1973	407.38	2229.39	423.86	2980.85		3312.73	423.86	483.08	280.48	1.100
1974			497.53	3301.34	1778.43		497.53			

INTERNATIONAL HARVESTER INPUT DATA (All current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	32.60	1082.46	321.22	636.28	330.34	1025.70	41.69	143.18	76.42	1.003
1960	62.61	1363.47	390.88	647.65		1145.28	55.79	114.21	53.72	.998
1961	54.91	1312.54	553.33	873.08		1456.67	56.25	93.23	48.44	.986
1962	58.78	1497.79	551.76	884.13		1471.73	56.41	125.31	60.23	.986
1963	76.12	1590.59	573.49	896.76		1527.38	57.64	125.66	68.29	.978
1964	80.60	1739.38	607.17	933.99		1561.16	65.42	187.57	98.68	.983
1965	120.44	1879.27	670.88	913.84		1667.81	62.34	186.51	100.58	.985
1966	99.16	2083.76	712.71	989.36		1814.61	70.51	199.89	109.67	.986
1967	93.48	2072.63	758.10	1039.86		1793.65	75.56	160.63	93.02	1.000
1968	102.03	2096.58	766.91	1095.60		1813.12	77.46	123.78	75.43	1.028
1969	99.24	2210.34	797.12	1139.41		1902.33	61.69	101.86	63.79	1.048
1970	99.44	2254.13	820.70	1200.40		2026.21	66.87	88.36	52.43	1.085
1971	70.55	2556.36	911.98	1257.96		2217.57	74.80	69.47	45.16	1.147
1972	68.10	2948.37	915.56	1275.16		2274.95	77.72	130.52	86.55	1.180
1973	113.58	3530.30	1122.22	1271.34		2574.34	77.66	143.40	106.89	1.192
1974			1279.95	1329.08	569.55					

KRAFTCO (Formerly National Dairy Products) INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	49.39	1188.28	163.75	462.32	253.42	558.09	31.79	101.22	49.36	.894
1960	45.03	1235.23	194.22	521.59		642.08	32.77	104.91	50.68	.895
1961	52.01	1345.51	224.59	542.31		670.34	34.38	103.58	50.21	.910
1962	50.49	1368.32	262.12	582.08		726.17	35.95	107.02	51.30	.919
1963	43.86	1376.67	238.72	604.18		774.27	36.95	113.38	54.02	.925
1964	47.08	1439.87	244.74	620.85		796.72	37.90	127.33	63.78	.923
1965	39.47	1520.75	241.76	633.27		824.63	38.22	132.44	69.90	.955
1966	44.20	1716.13	250.88	643.84		852.65	38.48	139.03	73.46	1.012
1967	53.40	1773.11	310.83	665.59		884.52	39.98	143.97	76.12	1.000
1968	47.52	1852.96	310.83	689.92		915.34	41.21	156.46	76.16	1.022
1969	58.53	1970.68	310.45	710.46		948.15	42.31	161.70	75.63	1.073
1970	77.14	2103.41	341.09	744.51		977.68	42.03	170.02	82.01	1.120
1971	89.73	2269.49	363.03	782.03		1031.37	40.73	186.80	91.35	1.143
1972	89.38	2457.72	410.88	835.96		1163.79	43.73	196.04	100.64	1.208
1973	71.81	2827.06	464.27	892.56		1245.19	46.69	197.87	103.43	1.481
1974			558.61	914.01	479.61					

NORTHROP INPUT DATA (all in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	4.62	208.95	21.62	28.31	18.54	95.63	3.39	15.25	7.33	.953
1960	7.93	183.07	21.79	33.86		108.97	3.64	16.10	7.74	.953
1961	12.73	211.22	41.04	40.67		96.00	4.36	16.76	8.67	.948
1962	12.26	277.92	61.26	51.13		127.97	4.99	18.41	9.05	.948
1963	16.48	276.09	58.50	60.95		138.11	5.25	18.62	9.06	.947
1964	12.26	239.81	86.94	75.06		168.08	6.21	13.59	6.77	.952
1965	6.58	269.72	115.64	84.31		162.90	6.17	16.65	8.68	.964
1966	7.21	276.89	102.53	88.80		158.11	6.07	20.03	10.47	.985
1967	20.96	375.95	131.33	93.21		200.03	6.14	22.46	12.57	1.000
1968	13.73	373.76	184.61	112.42		300.71	7.94	30.68	15.74	1.025
1969	24.01	439.22	359.28	121.76		400.08	9.74	39.04	18.50	1.060
1970	19.30	496.89	416.52	141.82		487.91	10.92	40.87	19.93	1.100
1971	18.07	469.60	337.61	157.14		526.62	11.22	22.73	11.00	1.140
1972	16.24	463.38	162.66	172.07		376.15	11.67	20.61	11.14	1.179
1973	12.68	571.70	175.40	185.21		347.17	12.17	20.08	11.61	1.259
1974			237.86	194.12	93.38					

SAFEWAY INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	82.12	1911.58	162.37	289.43	167.30	407.90	27.80	76.90	36.09	.871
1960	86.11	1964.66	163.31	313.60		425.64	29.18	75.55	35.19	.880
1961	76.82	2012.59	170.79	337.32		442.26	31.43	78.94	36.96	.891
1962	86.50	1977.24	174.94	337.81		454.28	30.98	83.67	39.62	.899
1963	87.34	2074.01	184.26	369.79		473.36	32.23	95.07	45.14	.912
1964	101.29	2199.10	197.54	398.50		508.06	34.18	98.19	50.29	.924
1965	93.76	2299.71	209.26	423.43		557.33	37.35	95.45	48.49	.944
1966	104.98	2618.47	224.27	457.71		576.70	38.75	118.08	60.04	.991
1967	107.95	2641.44	250.23	508.39		640.67	41.64	100.42	51.18	1.000
1968	104.32	2894.77	255.15	554.26		653.55	44.16	115.83	55.37	1.036
1969	132.59	3249.17	288.37	583.21		698.49	46.64	108.94	51.64	1.089
1970	146.35	3865.74	337.15	645.81		788.71	50.58	140.69	69.12	1.149
1971	170.07	4272.27	350.25	712.62		875.70	55.19	185.34	80.39	1.184
1972	214.06	4846.25	404.07	774.09		964.47	62.89	168.56	91.25	1.235
1973	205.23	5457.10	472.58	836.45		1137.37	69.58	157.50	86.46	1.414
1974			591.54	947.46	530.33					

TRW INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	17.39	340.74	47.16	136.78	77.63	203.52	11.84	19.81	9.74	1.003
1960	17.91	341.43	61.76	153.54		237.80	12.49	20.95	10.18	.988
1961	11.70	338.31	70.25	148.52		239.53	10.85	12.67	6.46	.986
1962	27.96	369.76	65.43	154.61		233.30	11.42	25.20	12.45	.986
1963	13.47	388.55	66.42	177.35		253.74	12.39	29.39	15.17	.978
1964	19.84	445.01	60.01	177.09		261.62	15.41	43.74	23.41	.983
1965	26.50	532.61	82.46	232.91		317.60	16.85	54.47	28.98	.985
1966	42.85	698.14	93.16	254.88		363.09	21.31	64.37	35.15	.986
1967	53.75	966.03	149.21	346.18		523.66	34.53	97.47	54.21	1.000
1968	59.15	1146.29	189.26	467.12		710.91	43.19	149.30	72.19	1.028
1969	73.49	1201.73	237.43	592.50		881.62	40.46	158.23	78.23	1.048
1970	69.03	1197.82	262.79	667.97		1028.21	44.01	148.28	79.32	1.085
1971	77.79	1173.41	281.91	716.78		1074.10	47.21	122.84	67.33	1.147
1972	69.36	1274.60	293.68	775.30		1115.94	51.40	137.99	76.11	1.180
1973	93.39	1667.25	333.66	833.59		1235.72	57.00	170.87	95.07	1.192
1974			412.94	927.91	426.08					

WESTINGHOUSE INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	45.24	1462.07	381.33	728.59	340.68	1411.51	46.05	156.06	78.75	.999
1960	67.93	1501.28	371.11	752.76		1498.53	46.78	148.18	79.06	.995
1961	76.97	1519.79	398.40	802.72		1521.14	46.83	89.10	45.45	.982
1962	49.27	1553.00	372.59	848.14		1531.78	55.64	100.37	57.06	.967
1963	53.94	1726.71	437.76	869.22		1516.46	59.25	88.37	47.82	.957
1964	52.84	1803.11	500.12	895.60		1542.57	60.82	140.35	76.68	.951
1965	75.41	1855.26	485.93	931.12		1606.57	63.35	196.71	106.90	.951
1966	128.06	1993.90	525.18	982.06		1711.52	59.70	223.85	119.66	.972
1967	147.27	2280.25	662.12	1079.00		1931.62	55.74	224.57	122.49	1.000
1968	207.96	2603.00	689.05	1194.81		2075.28	64.47	264.76	135.01	1.013
1969	173.66	2737.66	623.25	1364.97		2271.41	69.56	294.40	149.89	1.029
1970	207.41	3392.47	649.67	1527.06		2477.61	87.02	234.01	126.29	1.064
1971	200.02	3608.73	915.87	1872.55		3358.17	90.91	316.50	185.47	1.095
1972	224.72	3981.12	895.37	2018.90		3537.85	103.24	349.16	202.00	1.104
1973	202.41	4538.72	896.41	2219.08		3843.29	115.16	292.48	165.24	1.124
1974			1106.84	2413.15	1324.91					

BEATRICE INPUT DATA (all in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	8.37	319.87	18.66	85.31	44.52	102.14	6.68	20.93	10.31	.894
1960	9.67	346.43	21.35	96.63		118.93	7.11	21.62	10.75	.895
1961	10.73	391.01	22.62	100.39		126.84	8.08	23.76	11.82	.910
1962	10.67	412.90	26.85	108.28		140.49	8.71	26.80	13.02	.919
1963	11.23	435.70	28.10	117.65		149.85	9.80	30.21	14.71	.925
1964	11.33	498.19	30.24	131.26		165.91	9.99	36.05	18.05	.923
1965	14.26	577.70	40.77	142.41		184.14	12.23	47.14	24.64	.955
1966	19.19	658.31	51.08	172.13		228.34	13.19	56.28	30.28	1.012
1967	27.66	745.14	60.11	197.46		274.91	14.00	70.40	37.40	1.000
1968	71.13	920.35	82.33	220.45		343.45	17.07	84.17	43.67	1.022
1969	53.84	1109.41	116.45	256.13		438.98	23.17	103.93	54.53	1.073
1970	73.15	1306.24	156.28	366.26		631.48	27.38	115.99	63.89	1.120
1971	72.45	1751.83	180.94	427.11		748.03	35.78	146.17	80.70	1.143
1972	94.92	2063.49	227.38	542.01		934.15	38.61	170.01	93.00	1.208
1973	101.69	2659.96	277.11	607.70		1087.51	46.77	227.78	121.38	1.481
1974			412.30	729.91	434.42					

BOEING INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	17.52	1557.30	591.89	145.00	79.69	605.33	19.12	25.84	12.44	.953
1960	27.14	1472.93	615.94	161.93		595.34	21.08	51.76	24.46	.953
1961	26.77	1705.49	590.13	198.41		537.22	20.64	73.86	35.66	.948
1962	50.14	1687.19	512.49	213.62		587.38	21.05	56.25	27.15	.948
1963	28.24	1700.58	625.40	261.49		648.14	21.56	44.88	21.68	.947
1964	33.64	1852.76	670.68	285.46		690.27	24.67	89.02	45.32	.952
1965	67.76	1851.85	501.67	314.93		651.44	25.49	149.57	78.27	.964
1966	294.60	2177.85	562.09	379.83		762.23	40.17	140.63	76.13	.985
1967	246.50	2647.23	1062.11	671.88		1444.52	72.32	144.44	83.94	1.000
1968	120.50	3013.84	1628.11	914.69		2030.44	93.84	149.57	82.97	1.025
1969	89.80	2713.76	2199.41	1031.76		2186.12	105.33	<14.27>	10.23	1.060
1970	25.64	3517.20	2891.58	1105.60		2602.44	98.37	9.39	22.09	1.100
1971	14.44	2908.35	2447.01	1104.45		2621.82	89.61	12.17	22.43	1.140
1972	16.66	2235.67	1890.53	1077.26		2464.42	75.92	24.81	30.41	1.179
1973	35.78	3199.05	1753.38	1059.25		2127.40	65.99	57.82	51.22	1.259
1974			1400.14	1067.51	349.48					

COMBUSTION-ENGINEERING INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	4.15	280.79	65.64	80,85	47.72	208.14	6.02	15.26	6.97	.904
1960	6.05	223.44	49.12	93.97		176.96	6.06	12.42	5.86	.912
1961	4.34	253.57	48.53	88.79		179.17	6.17	14.17	6.22	.905
1962	3.42	221.39	38.20	80.50		173.91	5.13	15.60	6.68	.909
1963	7.75	255.93	41.91	81.95		186.73	4.61	16.48	7.25	.914
1964	15.04	269.70	47.36	87.46		205.71	5.69	16.09	8.12	.919
1965	23.45	356.20	49.89	99.99		217.75	7.07	23.02	12.08	.925
1966	21.22	491.36	85.90	122.84		272.96	9.00	34.07	17.27	.966
1967	32.42	616.53	94.61	142.58		303.40	11.97	42.31	21.88	1.000
1968	34.73	556.98	108.41	191.76		381.77	10.97	45.81	22.11	1.033
1969	23.56	691.30	143.80	254.03		501.34	13.21	54.61	26.57	1.070
1970	35.02	827.20	137.10	278.06		562.41	15.56	62.42	32.03	1.137
1971	42.20	926.15	177.47	322.96		630.25	17.89	67.41	35.75	1.191
1972	38.50	1028.78	218.31	355.95		721.51	19.62	72.08	39.30	1.224
1973	57.33	1103.34	222.33	386.07		739.84	22.98	79.43	43.09	1.270
1974			267.18	437.15	250.59					

DU PONT INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	165.77	1177.13	244.71	1904.08	799.30	2649.13	143.06	727.57	418.70	1.016
1960	205.41	1257.38	296.40	1998.75		2799.43	155.15	641.30	381.40	1.018
1961	193.93	1273.31	320.41	2166.44		2948.76	168.96	692.08	418.16	1.007
1962	245.49	1333.58	309.82	2301.17		3129.88	180.74	795.47	451.60	.991
1963	361.86	1418.37	343.93	2494.13		2860.61	199.47	832.40	472.26	.979
1964	277.18	1541.72	374.52	2801.44		2714.97	220.84	842.34	471.43	.983
1965	319.01	1670.38	400.22	3010.87		2382.71	242.49	777.10	407.23	.990
1966	520.46	1827.48	458.87	3266.74		2587.27	258.66	735.10	389.12	.994
1967	441.98	1858.64	542.62	3715.86		2778.44	280.54	578.19	313.86	1.000
1968	319.38	2018.36	519.81	4078.48		3071.11	300.46	769.48	371.87	.998
1969	380.23	2180.08	567.37	4296.19		3289.30	326.44	713.40	356.16	.999
1970	462.15	2260.62	672.31	4572.18		3452.78	348.55	591.21	328.71	1.022
1971	451.70	2429.90	751.49	4941.79		3566.60	373.10	621.50	356.50	1.042
1972	511.50	2770.20	746.90	5293.30		3998.50	391.90	748.50	414.50	1.042
1973	713.90	3330.50	793.20	5689.00		4283.70	423.80	1043.50	585.60	1.100
1974			839.70	6268.50	2402.80					

FORD INPUT DATA (All in current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	229.80	4,000.71	474.30	2598.67	1673.31	2,962.22	361.13	842.77	451.37	1.003
1960	292.06	3,994.33	520.41	2573.97		3,462.18	307.59	774.69	427.89	.988
1961	441.34	5,097.19	527.74	2678.40		3,756.80	394.64	828.43	421.43	.986
1962	450.99	6,209.30	989.18	3745.17		5,120.00	398.40	1003.74	490.33	.986
1963	572.62	6,802.76	1088.02	3970.37		5,416.47	421.82	1026.25	496.55	.978
1964	791.34	7,679.08	1193.67	4268.75		4,948.78	477.10	992.13	509.93	.983
1965	995.64	9,129.61	1443.73	4731.04		6,459.30	543.86	1305.28	709.68	.985
1966	1052.24	9,858.33	1668.88	5319.00		7,596.83	630.35	1166.84	627.24	.986
1967	1035.80	9,140.30	1946.10	5921.32		8,090.36	676.00	133.50	89.00	1.000
1968	879.30	11,468.30	1969.30	6593.70		7,966.80	748.20	1291.30	634.80	1.028
1969	957.80	12,162.00	2066.00	6928.10		8,953.20	803.70	1115.10	560.70	1.048
1970	1047.10	12,453.00	2285.90	7349.10		9,199.30	823.50	1006.20	526.40	1.085
1971	1039.20	13,481.30	2486.50	7853.20		9,904.10	823.60	1292.40	668.20	1.147
1972	1204.80	16,280.20	2539.50	8337.70		10,509.80	913.30	1662.60	889.30	1.180
1973	1486.00	19,069.30	2780.80	8897.10		11,634.00	948.20	1632.70	930.60	1.192
1974			3592.70	9652.10	5192.70					

GENERAL ELECTRIC INPUT DATA (All in Current $)

Year	I_t	Cost Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	91.34	3218.95	610.48	1553.02	712.67	2397.92	119.90	555.40	280.35	.999
1960	136.86	3171.80	626.20	1566.42		2535.96	116.03	392.90	2001.7	.995
1961	145.20	3337.86	655.16	1616.55		2522.25	117.88	486.32	242.16	.982
1962	124.42	3576.80	648.45	1673.45		2677.38	127.06	513.34	266.70	.967
1963	111.86	3556.64	722.77	1723.35		2819.55	127.70	549.34	271.56	.957
1964	130.04	3623.67	742.97	1751.51		2986.35	129.28	460.68	238.23	.951
1965	332.88	4445.92	820.82	1798.47		3090.42	188.41	690.14	337.97	.951
1966	484.86	5305.62	1136.93	2399.24		4260.41	233.63	664.52	317.08	.972
1967	567.65	5775.94	1472.96	2756.61		4789.20	280.42	669.45	348.93	1.000
1968	530.58	6247.41	1450.66	3222.08		5275.88	300.14	663.65	351.38	1.013
1969	530.59	6340.73	1482.11	3628.68		5683.57	351.28	507.24	275.74	1.029
1970	581.44	6423.61	1590.66	3982.10		5894.06	334.68	554.35	333.71	1.064
1971	559.90	6962.10	1555.31	3651.55		6198.51	273.60	792.10	475.00	1.095
1972	445.60	7509.60	1611.70	4134.20		6887.80	314.30	897.20	533.10	1.104
1973	598.60	8515.20	1759.00	4449.20		7401.80	334.00	1011.60	592.90	1.124
1974			1986.20	4919.80	2360.50					

GENERAL MOTORS INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Depreci-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	730.01	8,468.71	1529.51	5,934.03	2963.10	6,890.85	838.30	1792.20	873.10	1.003
1960	1141.06	9,665.51	1799.81	6,185.60		7,246.41	945.95	2037.54	959.04	.988
1961	914.13	8,593.22	1811.00	6,666.63		7,837.67	875.58	1768.02	892.82	.986
1962	1175.31	10,645.09	1800.14	7,004.85		8,272.60	971.56	2934.48	1459.08	.986
1963	1239.16	11,913.69	2006.49	7,510.11		9,169.05	1080.59	3353.92	1591.82	.978
1964	1681.53	12,454.93	2221.20	7,967.32		9,641.17	1086.02	3283.68	1734.78	.983
1965	2051.76	15,250.24	2677.85	8,864.59		10,292.83	1301.37	4091.61	2125.61	.985
1966	2078.83	15,404.12	2986.54	9,981.82		11,478.55	1514.93	3270.79	1793.39	.986
1967	1793.85	15,401.01	3103.29	11,012.19		12,213.49	1552.20	3013.38	1627.28	1.000
1968	1726.01	17,492.17	3210.41	11,761.26		13,273.08	1582.21	3524.81	1731.91	1.028
1969	1906.94	18,106.50	3423.34	12,422.00		14,010.18	1657.55	3454.00	1711.00	1.048
1970	2282.75	15,595.57	3760.53	13,211.27		14,820.09	1498.79	778.49	609.09	1.085
1971	1643.67	21,620.86	4115.06	14,528.28		14,174.36	1790.67	3719.81	1935.71	1.147
1972	1838.58	23,336.85	3991.57	14,938.54		18,241.90	1786.65	4222.61	2162.81	1.180
1973	2104.40	28,114.07	4200.16	15,468.76		18,273.38	1983.87	4513.10	2398.10	1.192
1974			5176.90	16,196.56	6251.23					

GREAT A&P TEA COMPANY INPUT DATA (All in Current $)

Year	I_t	Cost of Goods Sold	Beginning Inventory	Beginning Gross Cap. Stock	Beginning Net Cap. Stock	Value of Total Assets	Deprec-ation	Profits Before Taxes	Profits After Taxes	P_t
1959	51.90	4277.86	272.12	264.95	167.81	647.19	31.80	108.50	52.00	.871
1960	56.64	4408.88	287.34	293.82		674.62	35.55	123.21	59.01	.880
1961	57.75	4372.97	310.33	321.82		711.22	39.25	119.96	57.46	.891
1962	69.18	4368.26	330.25	343.79		744.05	43.73	126.61	60.21	.899
1963	49.12	4248.41	327.20	371.80		767.97	42.71	108.99	57.49	.912
1964	60.26	4141.37	331.91	401.77		786.53	42.00	98.63	52.13	.924
1965	58.99	4168.93	354.19	432.26		807.25	43.36	96.54	52.34	.944
1966	67.82	4449.04	370.11	460.34		835.80	47.42	105.74	56.24	.991
1967	63.36	4412.40	387.47	493.93		863.26	49.86	101.70	55.90	1.000
1968	62.89	4383.20	401.34	512.27		884.00	50.65	90.25	45.25	1.036
1969	61.42	4622.31	417.06	535.21		911.80	50.46	105.20	53.30	1.089
1970	60.06	4523.29	456.82	549.22		957.07	50.08	91.63	50.13	1.235
1971	61.99	4416.91	463.24	563.74		978.87	48.54	21.12	14.62	1.184
1972	48.46	5267.41	442.90	575.72		977.73	48.87	<105.28>	<51.28>	
1973	55.04	5513.57	484.01	566.12		1020.82	49.57	19.13	12.23	1.414
1974			544.14	564.79	360.25					

BIBLIOGRAPHY

[1] Accounting Principles Board Opinion No. 2. "Accounting for the Investment Tax Credit," December 1962, in APB Accounting Principles Original Pronouncements. 6/30/73 (Chicago: American Institute of Certified Public Accountants, Commerce Clearing House), p. 6508.

[2] Accounting Principles Board Opinion No. 4 (Ammending No. 2), "Accounting for the 'Investment Credit'," March 1964, in APB Accounting Principles: Original Pronouncements 6/30/73 (Chicago: American Institute of Certified Public Accountants, Commerce Clearing House), p. 6517.

[3] Alchian, A.A. "The Basis of Some Recent Advances in the Theory of Management of the Firm," Journal of Industrial Economics 14 (November 1965), pp.30-41.

[4] Arrow, K.J. "Optimal Capital Policy, the Cost of Capital, and Myopic Decision Rules," Annals of the Institute of Statistical Mathematics 16 (1964), pp. 21-30.

[5] Babcock & Wilcox Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[6] Babcock & Wilcox Company. Annual Report to Shareholders, Various Editions.

[7] Bailey, M.J. "Formal Criteria for Investment Decisions," Journal of Political Economy 67 (October 1959), pp. 476-88.

[8] Baker, R.T. "Accounting Is Being Challenged -- Needed, a Timely Answer," The Ohio CPA (Winter 1968), pp. 7-12.

[9] Ball, Ray and Philip Brown. "An Empirical Evaluation of Accounting Income Numbers," Journal of Accounting Research (Autumn 1968), pp. 159-78.

[10] Beaver, W.H. and R.E. Dukes. "Interperiod Tax Allocation and δ Depreciation Methods: Some Empirical Results," The Accounting Review Vol. XLLLVIII, No. 3 (July 1973), pp. 549-59.

[11] Beaver, W.H. and R.E. Dukes, "Interperiod Tax Allocation, Earnings Expectations, and the Behaviour of Security Prices," The Accounting Review Vol. XLVII, No. 2 (April 1972), pp. 320-22.

[12] Beatrice Foods Company. Annual Report to the Securities and Exchange Commission (Form 10-K) Various Editions.

[13] Beatrice Foods Company. Annual Report to Shareholders, Various Editions.

[14] Boeing Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[15] Boeing Company. Annual Report to Shareholders, Various Editions.

[16] Boot, J.C.G. and G.M. DeWit. "Investment Demand: An Empirical Contribution to the Aggregation Problems," International Economic Review 1 (January 1960), pp. 3-30.

[17] Bourneuf, A. "Investment, Excess Capacity, and Growth," American Economic Review, 54 (September 1964), pp. 607-25.

[18] Business Week (8/10/74), pp. 72-92.

[19] Chenery, H.B. "Overcapacity and the Acceleration Principle," Econometrica 20 (January 1952), pp. 1-28.

[20] Chow, G.C. "Tests of Equality Between Two Sets of Coefficients in Two Regressions," Econometrica 28 (July 1960), pp. 591-605.

[21] Chow, G.C. "Capital and Labor in Production: Some Direct Estimates," The Theory and Empirical Analysis of Production, Murray Brown (ed.). Studies in Income and Wealth, Vol. 31. New York: National Bureau of Economic Research, 1967, pp. 431-62.

[22] Combustion Engineering, Inc. Annual Report to the Securities and Exchange Commission (Form 10-K) Various Editions.

[22] Combustion Engineering, Inc. Annual Report to Shareholders, Various Editions.

[23] Complete Internal Revenue Code of 1954. January 1, 1974, Sections 38 and 48 (Prentice Hall Inc.).

[24] Dow Chemical Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[25] Dow Chemical Company. Annual Report to the Shareholders, Various Editions.

[26] E.I. DuPont De Nemours & Co. Annual Report to the Securities and Exchange Commission (Form 10- K), Various Editions.

[27] E.I. DuPont De Nemours & Co. Annual Report to Shareholders, Various Editions.

[28] Eisner, R. "A Permanent Income Theory for Investment," American Economic Review 57 (June 1967), pp. 363-90.

[29] Eisner, R. "Capital Expenditures, Profits, and the Acceleration Principle," Models of Income Determination, Studies in Income and Wealth, Vol. 28. Princeton: Princeton University Press, 1964, pp. 137-76.

[30] Eisner, R. "Investment: Fact and Fancy," American Economic Review 53 (May 1963), pp. 237-46.

[31] Eisner, R. and M.I. Nadiri. "Investment Behaviour and Neo-Classical Theory," The Review of Economics and Statistics Vol. L (August 1968), pp. 369-82.

[32] Eisner, R. and R. Strotz. "The Determinants of Business Investment," in D.B. Suits, et. al. Impacts of Monetary Policy. Englewood Cliffs: Prentice Hall, 1963, pp. 60-338.

[33] Elliott, J.W. "Theories of Corporate Investment Behavior Revisited," American Economic Review 63 (March 1973), pp. 195-207.

[34] "Statement of Financial Accounting Standards No. 2, Accounting for Research and Development Costs," (October 1974) Financial Accounting Standards Board, pp. 6-7.

[35] Feller, W. An Introduction to Probability Theory and Its Applications, Vol. 1, 2nd. ed. New York: Wiley, 1957.

[36] "Accounting for Investment Tax Credits," Financial Executive (December 1971), pp. 14-5.

[37] Fisher, I. The Theory of Interest. New York: Augustus M. Kelley, 1961 (original edition, 1930).

[38] Ford Motor Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[39] Ford Motor Company. Annual Report to Shareholders, Various Editions.

[40] General Electric Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[41] General Electric Company. Annual Report to Shareholders, Various Editions.

[42] General Motors Corporation. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[43] General Motors Corporation. Annual Report to Shareholders, Various Editions.

[44] Great Atlantic and Pacific Tea Company, Inc. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[45] Great Atlantic and Pacific Tea Company, Inc. Annual Report to Shareholders, Various Editions.

[46] Greenberg, E. "A Stock-Adjustment Investment Model," Econometrica 32 (July 1964), pp. 339-57.

[47] Griliches, A. "A Note on Serial Correlation Bias in Estimates of Distributed Lags," Econometrica 29 (January 1961), pp. 65-73.

[48] Grunfeld, Y. "The Determinants of Corporate Investment," The Demand for Durable Goods, A.C. Harberger (ed.). Chicago: University of Chicago, 1960, pp. 211-66.

[49] Grunfeld, Y. and Z. Griliches. "Is Aggregation Necessarily Bad?" Review of Economics and Statistics 42 (February 1960), pp. 1-13.

[50] Haavelmo, T. A Study in the Theory of Investment. Chicago: University of Chicago, 1960.

[51] Hall, R.E. and D.W. Jorgenson. "Tax Policy and Investment Behavior," The American Economic Review 57 (June 1967), pp. 391-414.

[52] Hickman, B. Investment Demand and U.S. Economic Growth. Washington: The Brooksings Institution, 1955.

[53] Hirshleifer, J. "On the Theory of the Optimal Investment Decision," Journal of Political Economy, 66 (August 1958), pp. 339-52. Reprinted in E. Solomon (ed.). The Management of Corporate Capital. Glencoe: The Free Press, 1952, pp. 205-25.

[54] International Harvester Company. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[55] International Harvester Company. Annual Report to Shareholders, Various Editions.

[56] Jaszi, G.; R. Wasson; and L. Grose. "Expansion of Fixed Business Capital in the United States," Survey of Current Business 42 (November 1962), pp. 9-18.

[57] Jorgenson, D.W. "Anticipations and Investment Behavior," The Brooksing-SSRC Quarterly Econometric Model of the United States. J.S. Duesenberry, E. Kuh, G. Fromm, and L.R. Klein (eds.). Chicago: Rand-McNally, 1965, pp. 35-92.

[58] Jorgenson, D.W. "Capital Theory and Investment Behavior," American Economic Review 53 (May 1963), pp. 247-59.

[59] Jorgenson, D.W. "Rational Distributed Lag Functions," Econometrica 34 (January 1966), pp. 135-49.

[60] Jorgenson, D.W. "The Theory of Investment Behavior," in Universities NBER Committee for Economic Research, Determinants of Investment Behavior. Robert Ferber, ed. New York: National Bureau of Economic Research, 1967, pp. 681-712.

[61] Jorgenson, D.W. and C.D. Siebert. "A Comparison of Alternative Theories of Corporate Investment Behavior," The American Economic Review 58, (September 1968), pp. 681-712.

[62] Jorgenson, D.W. and C.D. Siebert. "Optimal Capital Accumulation and Corporate Investment Behavior," Journal of Political Economy, 76 (Nov.-Dec. 1968) pp. 1123-51.

[63] Jorgenson, D.W. and J.A. Stephenson. "Investment Behavior in U.S. Manufacturing, 1947-60," Econometrica, 35 (April 1967).

[64] Jorgenson, D.W. and J.A. Stephenson. "The Time Structure of Investment Behavior in U.S. Manufacturing, 1947-60," Review of Economics and Statistics, 49 (February 1967), pp. 16-27.

[65] Journal of Accountancy (January 1975), pp. 7-8.

[66] Kaplan, Robert S. and Richard Roll. "Investor Evaluation of Accounting Information: Some Empirical Evidence," Journal of Business, (April 1972), Vol. 45, No. 2, pp. 225-257.

[67] Klein, L.R. Economic Fluctuations in the United States, 1921-1941. New York: Wiley, 1950, pp. 14-40.

[68] Kraftco Corporation (formerly National Dairy Products Corporation). Annual Report to the Security and Exchange Commission (Form 10-K), Various Editions.

[69] Kraftco Corporation. Annual Report to Shareholders, Various Editions.

[70] Kuh, E. Capital Stock Growth: A Micro-Econometric Approach. Amsterdam: North Holland Publishing Co., 1963.

[71] Lerner, E.M. and A. Rappaport. "Limit DCF in Capital Budgeting," Information for Decision-Making: Quantitative and Behavioral Dimensions. A. Rappaport, ed., Prentice Hall, 1970, pp. 301-13.

[72] Machlup, F. "Theories of the Firm: Marginalist, Behavioral, Managerial," American Economic Review, 57 (March 1967), pp. 1-33.

[73] Malinvaud, E. "Capital Accumulation and Efficient Allocation of Resources," Econometrica, 21, No. 2 (April 1953), pp. 233-68.

[74] Masse, P.B.D. Optimal Investment Decisions. Englewood Cliffs: Prentice-Hall, 1962.

[75] May, R.G. "The Influence of Quarterly Earnings Announcements on Investor Decisions as Reflected in Common Stock Price Changes," Empirical Research in Accounting: Selected Studies, 1971, Supplement to Vol. 9. Journal of Accounting Research, pp. 119-63.

[76] Mayer, T. "Plant and Equipment Lead Times," Journal of Business, 33 (April 1960), pp. 127-32.

[77] Meyer, J. and R.R. Glauber. Investment Decisions, Economic Forecasting and Public Policy. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1964.

[78] Meyer, J. and E. Kuh. The Investment Decision. Cambridge: Harvard University, 1957.

[79] Mills, R.H. "The Investment Credit," Financial Analysts Journal (November-December 1971), pp. 71-7.

[80] Modigliani, F. and M. Miller. "The Cost of Capital, Corporation Finance, and the Theory of Investment," American Economic Review, 48 (June 1958), pp. 261-97.

[81] Moody's Industrial Manual. New York: Various Annual Issues.

[82] Moonitz, M. "Can Laws Coerce Accounting?" The Journal of Accounting Research (Spring 1967), pp. 129-30.

[83] Moonitz, M. "Some Reflections on the Investment Credit Experience," Journal of Accounting Research (Spring 1966), pp. 47-61.

[84] Moonitz, M. "The Accounting Principles Board Revisited," New York CPA (May 1971), pp. 341-45.

[85] Myers, A.R. "Comment on Opinion No. 4," Journal of Accountancy (August 1964), p. 23.

[86] Northrop Corporation. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[87] Northrop Corporation. Annual Report to Shareholders, Various Editions.

[88] Rao, P. and R.L.R. Miller. Applied Econometrics. Belmont, California: Wadsworth Publishing Co., 1971.

[89] Roos, C.F. "The Demand for Investment Goods," American Economic Review, 38 (May 1948), pp. 311-20.

[90] Roos, C.F. and V.S. Von Szeliski. "The Demand for Durable Goods," Econometrica, 11 (April 1943), pp. 97-122.

[91] Safeway Stores, Inc. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[92] Safeway Stores, Inc. Annual Report to Shareholders, Various Editions.

[93] Siegel, S. Nonparametric Statistics for the Behavioral Sciences. McGraw-Hill, 1956.

[94] Simon, H. "New Developments in the Theory of the Firm," American Economic Review, 52 (May 1962), pp. 1-15.

[95] Smith, V.L. Investment and Production. Cambridge: Harvard University Press, 1961.

[96] Solow, R.M. "On a Family of Lag Distributions," Econometrica, 28 (April 1960), pp. 399-406.

[97] Stamp, E. "Some Further Reflections on the Investment Credit," Journal of Accounting Research (Spring 1967), pp. 124-8.

[98] Theil, H. Economic Forecasts and Policy, 2nd. ed. Amsterdam: North-Holland Publishing Company, 1961.

[99] Theil H. Linear Aggregation of Economic Relations. Amsterdam: North-Holland Publishing Company, 1954.

[100] TRW, Inc. (formerly Thompson-Ramo-Wooldridge). Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[101] TRW, Inc. Annual Report to Shareholders, Various Editions.

[102] U.S. Public Law 92-178, Section 50, Paragraph C, printed in U.S. Code Congressional and Administrative News, 1, 92d Congress, 1st session, 1941, p. 547.

[103] U.S. Department of Commerce, Bureau of Economic Analysis, Business Conditions Digest, various monthly issues.

[104] U.S. Department of Commerce, Office of Business Economics. Business Statistics: A Supplement to the Survey of Current Business, 1971.

[105] U.S. Department of Commerce, Bureau of Economic Analysis. Survey of Current Business, Various monthly issues.

[106] U.S. Department of Labor, Bureau of Labor Statistics. Handbook of Labor Statistics. 1973, pp. 311-20.

[107] U.S. Department of Labor, Bureau of Labor Statistics. Wholesale Prices and Price Indexes. Various monthly issues.

[108] Walker, C.E. Letter to Senator Russell B. Long dated November 12, 1971 excerpted in Journal of Accountancy (February 1972), p. 72.

[109] Walters, A.A. "Production and Cost Functions: An Econometric Survey," Econometrica, 31 (April 1963), pp. 1-66.

[110] Westinghouse Electric Corporation. Annual Report to the Securities and Exchange Commission (Form 10-K), Various Editions.

[111] Westinghouse Electric Corporation. Annual Report to Shareholders, Various Editions.

[112] Williamson, O.E. "Managerial Discretion and Business Behavior," American Economic Review, 53 (December 1963), pp. 1032-57.

[113] Williamson, O.E. The Economics of Discretionary Behavior: Managerial Objectives in a Theory of the Firm. Englewood Cliffs, N.J.: Prentice-Hall, 1964.